THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. X.—No. 218.

METROPOLITAN FIRE TELEGRAPHS.

FROM the report of the chief officer of the fire brigade for 1881, which has recently been issued, it appears that the number of calls for fires, or supposed fires, received at the fire brigade stations during the year 1881 was 2,376. Of these 240 were false, and 145 only chimney alarms; 1,991 were calls for fires, of which 167 resulted in serious damage, and 1,824 in slight damage. The number of fires in the metropolis in which life was seriously endangered was 154, and in 40 cases out of these lives were lost.

This interesting official report provides us also with a large number of detailed data relating to the quantity of water used, the strength of the brigade, number of engines, &c., and from these data we also find that there are 53 land fire-engine stations and 4 floating stations, 53 telegraph lines, 7 telephone lines, 7 fire-alarm circuits with 44 call-points. The report also states that the fire-alarm circuits have been of great service, &c.

We have certainly every reason to express our thanks to the chief officer (Captain Shaw) of the London Fire Brigade for his indefatigable labours and his gallant efforts to bring his brigade to the utmost perfection, and we think that not only the metropolis, but every town in Great Britain owes thanks for such a praiseworthy example.

In a paper read before the So ciety of Telegraph Engineers on the 28th of February, 1877, Mr. von Fischer Treuenfeld, strongly recommended the adoption of fire-alarm circuits, with automatic call-points accessible to the general public; such telegraphic communication was then unknown in England, and it is highly satisfactory to see that since that paper was read a first step has been taken, and that the highest authority in matters of fire brigades has officially given a favourable report. That such must be the case could hardly have been doubted for a moment by any who had read Mr. Treuenfeld's paper, because the results there shown, collected from a very large number of official reports obtained from numerous fire brigades in Europe and America, decidedly proved that automatic call-points and telegraph circuits do reduce the proportion of serious fires, and there is no reason whatever why fire telegraphs would not produce the same advantageous results in England as they have done years ago in many European and American towns.

It would perhaps be opportune to repeat here the official results which Mr. Treuenfeld obtained and laid before the Society of Telegraph Engineers. The extensive tables in that report proved that towns with perfect fire telegraphs and automatic call-points have their serious fires reduced to an average percentage of 4; the less perfect systems show more frequent serious fires, giving an average number of 17; while the percentage in towns possessing no fire telegraphs reads as high as 29.

It was also proved that the percentage of fires resulting in "total destruction" must likewise be exceedingly high in towns without fire telegraphs, and that a reduction of 50 per cent. in fires of total destruction is attained from the moment automatic fire alarms are established in sufficient numbers.

Let us now see how the serious fires from 1871 to 1876 compare with those in 1881, that is, after a small number of call-points had been established in London.

YEAR.	FIRES IN LONDON.		
	Total Number.	Serious Fires.	Percentage of Serious Fires.
1871 to 1st January, 1876	8,026	850	10·5
1881	2,136	167	7·8

We have here evident proof that the percentage of serious fires has been reduced from 10·5 per cent. to 7·8 per cent., and there is every reason to suppose that this satisfactory result is due to a great extent to the adoption of call-points, of which there are as yet too insufficient a number.

With a complete system of call-points over the entire metropolis, it is certain that the percentage would not be 7·8, but 4, as has been the case in other towns under similar circumstances.

Referring again to the official report of the chief of the Metropolitan Fire Brigades, we are informed that there are:—

Land fire-engine stations	53
Floating fire stations	4
Call-points	44
Total number of points for calls... ...	101

Taking the population of London in round numbers as 3,000,000, we then have one call-point to each 29,703 inhabitants, which compares well with the year 1876, when London had only one call-point to each 52,925 inhabitants. But how far we are still from perfection in this respect is shown at a glance by a comparison with German towns, where, as a rule, there is one call-point to 1,000 to 5,000 inhabitants, and many American cities show even a far more favourable proportion.

The efficiency of automatic fire telegraphs for the reduction of serious fires has been proved beyond doubt; a number of official reports of modern date all agree to the fact; and it is only necessary to bring forward one, taken at random and it proves the same over again.

The report of the chief of the fire brigade of Amsterdam, "Verslag van het Brandwezen der Gemeente, Amsterdam,

1880," gives the following data relating to the automatic fire telegraphs of that town :—

YEAR.	FIRES.		
	Total Number.	Serious Fires.	Percentage of Serious Fires.
1867	244	23	9·42
1868	288	18	6·25
1869	287	16	5·57
1870	369	35	9·45
1871	328	17	5·76
1872	337	25	7·41
1873	295	24	8·17
1874	435	32	7·35
1875	550	27	4·90
1876	689	22	3·19
1877	664	15	2·25
1878	809	29	3·58
1879	1,034	29	2·80
1880	998	27	2·70

The automatic fire telegraph of Siemens' system was opened in Amsterdam on the 15th of August, 1874, and a glance at the above table shows how the percentage of serious fires was at once reduced after 1874, falling off to about one-third of what it was before the establishment of automatic fire telegraphs.

Amsterdam, with a population of 290,000 inhabitants, has 38 Morse fire telegraph stations and 142 automatic call-points—together 180 call-points, or one point for each 1,611 inhabitants.

The question has often been raised, whose duty is it to provide towns with automatic fire alarms? Is it the duty of the fire brigades, or the corporation of the town, or the post-office, or the police, or is it to be left to private enterprise? Chiefs of fire brigades have said: "Our duty begins at the moment we are informed of the outbreak of a fire, but we have nothing to do with the communication from the place of fire to the station of the brigade!" This is bad reasoning; a general would simply be superseded were he to only think of fighting his enemy, and not of ascertaining his position! Fire telegraphs serve for purposes of the brigade, and hence it is the duty of the brigades to provide these means of rapid communication. It is to be hoped in the interest of the protection of life and property, that reports like that of the chief of the Metropolitan Fire Brigade, may be well studied and considered by all other chiefs of fire brigades, and that such cases, where the chief of a corporation of a British town of 80,000 inhabitants states "that his town has no fire telegraph stations, nor in fact a fire brigade," may at once belong to a past century.

THE POSTMASTER-GENERAL AND THE TELEPHONE.

AN interesting correspondence has recently taken place between The British and Irish Telephone and Electric Works Company, Limited, and the Postal Telegraph Department, interesting, because it affects, by the decision contained in the Postmaster-General's replies, not only the company applying for information, but probably also the future efficiency of the public telephone service and also the progress of any new telephonic invention.

What says the Attorney-General as to the legality of Mr. Fawcett's decision?

We print herewith in full the letters which have passed between the applicant company and the Department, having first numbered them consecutively.

No. 1.

BRITISH AND IRISH TELEPHONE AND ELECTRIC WORKS CO., LIMITED,
28, Queen Street, Cheapside, E.C.,
October 20th, 1881.

To the Secretary, General Post Office, E.C.

SIR,—I am instructed by my directors to inquire on what terms the Department will authorise this company to establish telephonic exchanges in all or any of the following cities and towns:—

Liverpool, Birmingham, Sunderland, Edinburgh, Hull, Bradford, Halifax, Bristol, Sheffield, Bolton, Newcastle, Glasgow, Dundee, Leeds, Huddersfield, Keighley and Bingley, Nottingham, Blackburn, Preston?

I have the honour to be, Sir, your obedient servant,
W. H. G. EXTON, Secretary.

No. 2.

GENERAL POST OFFICE,
October 29th, 1881.

SIR,—I have laid before the Postmaster-General your letter of the 20th instant, inquiring on behalf of the Directors of the British and Irish Telephone and Electric Works Company, Limited, on what terms this Department will authorise the company to establish telephone exchanges in the towns mentioned in that letter, and in reply I am to inform you that inasmuch as in all those towns, except Hull and Newcastle, licenses have already been granted to work exchanges, Mr. Fawcett does not consider that a necessity has at present arisen for granting a license to another company. He is not therefore, at present, prepared to grant further licenses, but should circumstances render competition desirable he will be ready to consider any application the British and Irish Telephone Company may wish to make.

In the case of Hull and Newcastle the Department has itself established systems of telephonic intercommunication, and Mr. Fawcett does not propose to license any private companies.

I am, Sir, your obedient servant,
S. A. BLACKWOOD.

The Secretary, British and Irish Telephone and Electric Works Company, Limited.

No. 3.

BRITISH AND IRISH TELEPHONE AND ELECTRIC WORKS CO., LIMITED,
28, Queen Street, Cheapside, E.C.,
8th November, 1881.

To the Secretary, General Post Office.

SIR,—Your favour of the 29th ult. has been brought before the board of this company at our meeting to-day, and we think that, perhaps, our secretary's letter of the 20th ult. did not sufficiently explain the objects the company had in view in applying for a license to establish telephonic exchanges.

The various companies to whom the Postmaster-General has, so far, granted licenses for the cities and towns in question have agreed with one another and virtually constitute a monopoly. This company only seek the privilege of affording the public a far cheaper, and they hope, a better telephonic service by means of exchanges than the associated companies give, in addition to selling, as this company are at present doing, the best telephones for private use, which the other companies have agreed not to do.

Seeing that the Post Office have already granted licenses for exchanges, amongst others, the United Telephone Company, the Lancashire and Cheshire Telephone Company, Messrs. Moseley & Son, Manchester, the National Telephone Company, Messrs. Sharples, of Preston, Messrs. Cox & Williamson, of Plymouth, Messrs. Tasker, of Sheffield, my board can scarcely think that the department will now absolutely exclude this company in carrying on their business from facilities already extended by the Post Office to the various companies and private individuals enumerated.

As regards Hull, this company have already been influentially solicited to form a telephonic exchange there, in consequence of what we are informed are considered the present comparatively prohibitory charges.

I would also venture to remark that as my company are willing to agree to any reasonable terms, such as are ordinarily required by the Post Office from others for exchanges, this company's operations would certainly tend to benefit the Post Office receipts by the great extension of telephonic intercommunication which lower rates are certain to produce.

I would also mention that we assumed this company would be put on an equal footing with others to whom the Post Office have granted such facilities, and therefore, pending your reply to our letter of the 20th ult., we advertised extensively for suitable accommodation for telephone exchanges in the various places we specified, and as negotiations are pending on this subject, I venture to ask for an early reply.

For your information I take the liberty to inclose one of the original prospectuses of the company.

I have the honour to be, Sir, your obedient servant,
E. B. BRIGHT, Chairman.

No. 4.

BRITISH AND IRISH TELEPHONE AND ELECTRIC WORKS CO., LIMITED,
28, Queen Street, Cheapside.
November 30th, 1881.

To the Secretary, General Post Office.

SIR,—I am requested by the board to write again relating to the application this company made on the 20th October last for licenses to establish telephone exchanges in the twenty cities and towns named.

In the further letter I had the honour to address to you on the

8th instant I pointed out that the existing companies by arrangements with one another had established a monopoly, and that this company wished to compete with their comparatively prohibitory charges.

In Manchester alone we have before us the question of providing an exchange in connection with about two hundred subscribers, we also have important applications from Edinburgh, &c.

We therefore hope to receive an early and favourable reply, as I need scarcely point out that if the licenses are still refused this company's efforts to supply the public with telephone exchanges on far more moderate terms than the present companies will be paralysed. We are already much prejudiced by the delay in according us these facilities as every day more of the public are driven to arrange with the other companies owing to our not being able to do so.

I have the honour to be, Sir, your obedient servant,

(Signed) E. B. BRIGHT, Chairman.

No. 5.

BRITISH AND IRISH TELEPHONE AND ELECTRIC WORKS CO., LIMITED,
28, Queen Street, Cheapside.
December 30th, 1881.

To the Secretary, General Post Office (172,487).

SIR,—I am instructed by my directors to take the liberty of referring you to the correspondence on the subject of this company's application for licenses to establish telephonic exchanges in the various cities and towns enumerated in the letter I had the honour to address to you on the 20th October last and also to refer to the two letters addressed to you by the chairman of the company (Mr. E. B. Bright), dated the 8th and 30th November last, which have not as yet received acknowledgment or reply.

At the general meeting of the shareholders held on the 14th instant, surprise was expressed at the reasonable application of this company to compete with other companies and private individuals not having been conceded, and the board were then requested to publish the correspondence and to take measures for the subject being discussed in Parliament.

My directors are, however, reluctant to do this, but at the same time they are bound in the interests of the company to urge strongly that a compliance should be given, and in the event of no favourable answer being received by the 5th proximo they desire me to say they will feel bound to carry out the wishes of the shareholders, as the most important part of the company's business is really being paralysed by this delay which only enables the various companies and individuals antagonistic to this company to make further progress, while at the same time the delay only helps to further establish the monopoly which has been created.

I have the honour to be, Sir, your most obedient servant,

W. H. G. EXTON, Secretary.

No. 6.

GENERAL POST OFFICE, LONDON,
January 4th, 1882.

SIR,—Before the receipt of your letter of the 30th ultimo., the Postmaster-General had had before him your letters of the 8th and 30th November, in which you urge a reconsideration of his decision not to grant licenses to the British and Irish Telephone and Electric Works Company for Telephone Exchanges in certain towns.

It is now generally recognised that it is not for the public interest that several rival exchanges should be established in one town, an important condition of the exchange system being thate very subscriber should be able to communicate with every other subscriber.

Although, therefore, the Postmaster-General has carefully guarded himself from making any of the licenses which he has granted exclusive, yet in view of the general satisfaction which, so far as he is aware, is being given by the existing telephone companies, and the absence of complaint or remonstrance to himself from the communities concerned, he does not feel called upon to grant further licenses.

I am to add that if in any case it appeared that an existing company were using its position improperly, and that the public had ground for dissatisfaction, the Postmaster-General would be prepared to take steps himself to meet any reasonable public demand.

I am, Sir, your obedient servant,

C. H. B. PATEY.

E. B. Bright, Esq.,
British and Irish Telephone Company, Limited.

Of these letters we propose to direct attention mainly to those numbered **2** and **6**, for they convey an insight into the views of the Postmaster-General, whilst the others relate principally to the requirements of the British and Irish Telephone Company from whom they emanate, and against the fairness and reasonableness of which letters we can urge but little.

By letter 2 it will be seen that the Postmaster-General claims the right to judge when competition is desirable. Considering that when the Bell telephone was first introduced into England, and indeed for some time after its introduction, that instrument was treated and spoken of by the highest officials of the Telegraph Department as a toy, admittedly a wonderful invention, but still only a toy, and one with which the Department had no concern whatever; and then remembering that after the telephone had become fairly established and was beginning to interfere in some quarters with the revenue of the Department, it discovered that the telephone was a telegraphic instrument, and must pay royalty and be brought into subjection by the Department or be suppressed. We say, considering and remembering as we do these things, we cannot admit that the Postmaster is justified in taking up such a decisive attitude as that in which he now poses in the correspondence which we have printed above. Firstly, the Department considers the telephone a toy; secondly, it considers it is a telegraphic instrument, and that to use it for exchange purposes is an infringement of the Telegraphic Acts; and, thirdly, it determines to establish for the Exchange Companies, who work the Bell patents, what is virtually a monopoly.

We are not surprised to hear very severe comments and harsh accusations made against those officials whose duty it probably has been to advise with Mr. Fawcett in this matter, but as the honour of these gentlemen is so well known they can probably afford to pass by any such unfavourable comments in silence. It is however to be hoped that no recently begotten friendships have had weight, perhaps all unconsciously, in influencing those whose advice the Postmaster-General would most likely consult before he arrived at the decision above stated.

Before Mr. Fawcett makes his decision (so far as he is concerned) quite final, it would be well to ask himself whether he is dealing in this matter conscientiously and as his right judgment would dictate. With that gentleman, we are happy to say, it is peculiarly appropriate to appeal on the score of conscience, because the Postmaster-General stands forward most prominently as a man who, whatever may be the degree of his fallibility, always endeavours to act in accordance with the dictates of his judgment, but only when guided by a sense of what is strictly just and good.

A great error of omission it is generally thought was committed by the department when the telephone was first introduced here. Is that error to be, as many other errors have been, the parent for further and more egregious blunders?

Have the existing united exchange companies shown such an aptitude for business that no others should be allowed to quicken and facilitate telephonic means of communication by competition with them?

How many subscribers are there in London (the most populous city in the world), and this after years of working?

Will the number compare with similar figures in towns in America, in which country the telephone practically started about the same time as in England, or will it in the comparison, especially when the population of this town is taken into consideration, appear ridiculously small?

From the standpoint of efficient service to the public, we think competition should be allowed, an equal royalty being in all cases required. If the existing services are good, and if the desirability of intercommunication between one member of a community and any other member of that same body be so apparent, why then competition may fairly be allowed, for it could do but little harm. Whereas if the service is indifferent, or wanting in energy, or the charges immoderate, why then competition is the very thing to effect a cure, and therefore whichever way the question is regarded, this special regulation on the part of the Postmaster-General appears to us as unjust as it is unnecessary.

There is another light in which this decision of the Postmaster, must be regarded, it is in that of invention. We have seen that the Bell telephone, capable of so much as its talented inventor had made it, was in its first years of existence and even for some time after it was in public use in London, looked upon as an impracticable invention, a sort of scientific plaything; yet with the experience gained by practical application it became so potent a messenger that the Department was compelled to interfere. Now we will suppose that a new telephone is brought out (as one probably will be ere long). That practical experience so necessary to perfecting it is, by Mr. Fawcett's decision, denied to its promoters, and therefore any future telephonic invention may by the Postmaster's regulation be consigned to oblivion and its inventor abandoned to despair.

The whole matter is one of great importance, and we trust the manliness of Mr. Fawcett will speak out forthwith, and thus avoid the necessity for the intervention of parliament in a matter that should be especially his, but in which we cannot but feel he has either judged hastily, or been ill-advised.

ON ELECTRIC LIGHTING FOR SHIPS AND MINES.

TRANSACTIONS OF THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.

By Mr. ANDREW JAMIESON, C.E., Principal, College of Science and Arts. Received and read 20th December, 1881.

IT is only about ten months since Swan lamps, or any other incandescent form of electric lamp, could be procured in any desired quantity in Great Britain. It is a still shorter time (about six months) since the plan of applying this form of electric light to steamships and mines was first tried. During this period Swan's Electric Light Company have had their lamps permanently fitted into the following steamships:—

Name of Ship.	Approximate Number of Swan Lamps used.	Electric Machine used.	No. of Trips.
H.M.S. *Inflexible*	150	—	Cruising.
SS. *City of Rome* ..... (Inman Line)	250	Siemens' alternate current.	1
,, *City of Richmond* ... (Cunard Line)	56	Brush	5
,, *Servia* (Cunard Line)	117 (2 arc lights)	Siemens' alternate current.	1
,, *Arabic* (White Star Line)	130	do.	2
,, *Coptic* do.	130	do.	1
,, *Alaska* (Guion L.)	250	do.	1
,, *India* (B. I. Line)	—	do.	On her first voyage.

Besides these, two ships, the steamships *Columbia* and *City of Worcester*, have been fitted in America with Edison lamps. From the above facts it is evident that electric lighting is fast replacing the former method of lighting saloons, berths, engine and boiler rooms, on board our new first-class passenger steamers. The advantages over lighting by means of oil are many. There is very little heat given off, no smell, no products of combustion to tarnish gilt work or produce headaches and sea-sickness. No matches are required, and little or no attention on the part of the stewards; for it is only requisite that a man be sent round once a day to see whether any of the lamps require renewal, and the renewal of a lamp is performed as simply as the putting of a fresh candle into a candlestick. Instead of the erratic and somewhat clumsy oil lamp, we have a steady, pure, white light, encased in neat, tiny, glass globes, which passengers are sure to like more and more.

The danger, annoyance, and time spent in having to store and tally out large quantities of paraffin or other oil, as well as matches, may be thus avoided. (Electric cigar and pipe-lighters, for use in the smoking-room or on deck, can easily be made a part of the installation.)

You will best understand the general arrangement employed in carrying out this new form of lighting on board ship if I give you an account of how Swan's system was fitted on board the ss. *Servia* (which I officially inspected for his company). In a recess off the engine-room between decks, was placed a three-cylinder Brotherhood engine, driving directly without any intermediate gearing or multiplying power a Siemens' dynamo exciter and alternate current machine at 650 revolutions per minute. The electric current generated by the dynamo exciter served solely to feed the electro-magnets of the alternate current machine, whilst the revolving armature or bobbins of the alternate current machine produced the necessary electric currents for the 117 Swan lamps used in the saloon, music room, ladies' room, engine and boiler rooms, smoke room, &c., as well as for the two Siemens' arc lights for use on deck when taking in or discharging cargo, &c.

The alternate current machine was divided into four separate circuits, each being connected by a stout well-insulated lead, to a commutator or distributing plate fixed to the bulkhead opposite the machine. By means of this commutator the electricity generated in the four separate circuits could be combined into one current, or divided into two or three, or used in four distinct circuits, each independent of the other. For instance, if it was necessary to have the saloon brilliantly lighed, while the smoking-room or certain cabins were not required to be lit, the electricity could be cut off from the latter, and shunted on to the former, or *vice versâ*, as the case might be. Then again, when in port, or when any very particular work is required to be done at night on deck at or near the hatches, electricity can be conveyed from one of the four separate circuits of the generator, and brought to bear upon the arc lights, *totally* independent of and unaffected by the other three circuits feeding the Swan lights in the saloon, engine room, and elsewhere.

In this way, you have certain advantages, arising from using a separately-excited alternate current machine, over that of a self-excited dynamo, not only by being able to feed independently or collectively the different incandescent lamp circuits at pleasure, but also by being able to use arc lights without interfering with the Swan lights; it is, moreover, a compact arrangement, and does not require to be driven at such a high speed as self-excited dynamo machines of the same power usually do. It is probably not such an economical method as far as steam and coal are concerned, but in a large steamer the amount of extra coal required for such a purpose is hardly appreciated.

Well, the electricity is conveyed from the large commutator situated in the dynamo room to various parts of the ship, by means of stout stranded copper conductors, well insulated by an india-rubber dielectric and tapeing. In each place, switches fitted with a special key were placed in the circuit of these main leading wires, whereby a number of the lamps might be lighted or extinguished at pleasure, and in some cases smaller switches were placed in the branch currents at those lamps near the entrances to the saloon, &c., for the purpose of actuating single lamps. In fact, the whole system was as easily under control, as far as putting it out and in, as gas could be. In the engine room, lamps were fixed with reflectors in the most appropriate places for throwing light upon the working parts, even to the thrust bearing in the shaft tunnel; and in the boiler rooms, a Swan lamp with a reflector, was placed opposite each of the water gauge glasses, in such a position that the height of the water could easily be distinguished when standing on the stoke hole floor. Siemens' largest size of coupled exciter, and generator $\left(\frac{W' \text{ (generator)}}{D' \text{ (exciter)}}\right)$, is capable of lighting 200 Swan lamps at 15 to 16 candle-power each, and in doing so, it will require 25 actual horse-power to drive it, but 25 horse-power more or less is barely felt in the case of large new first-class passenger steamers with engines of 5000 horse-power and upwards.

The cost of fitting up the *Servia*, in the very complete manner in which it was done by the Swan Company, could not have been less than £1,000. Some may think this a large sum, but it must be remembered, that the circumstances are exceptional, and that large steamship companies may well find it worth their while to secure every possible comfort and luxury for their passengers, even though it should cost a little more than a less attractive and efficient method.

In regard to electric lighting for mines, only two have as yet been fitted with Swan lamps—"Earnock" and "Risca"—and I do not know of any others having been permanently fitted with any other form of incadescent lamp. Mine-owners were cautiously waiting to see how it answered in these two cases, before trying it upon their own.

(Mr. Jamieson here explained in detail how Swan's lamp was constructed, showing by experiment how the treatment of blotting paper with sulphuric acid (2) to water (1), rendered it tough and strong, in the same way as Swan treated his cotton threads before carbonising them in a hermetically sealed metal case.) He then gave a general sketch of how the system had been carried out at Earnock Colliery, by aid of a wall diagram which he had made from a tracing given to him by Mr. Gilchrist, the manager of the mine. He also explained his working model for a protecting lantern, which he, as well as others, had hoped would have formed such an excellent miners' safety lamp, but practically the difficulty of moving it about, attached as it had to be to the main electric conductors by an insulated metal "tether," rendered it inconvenient, and as far as an electric safety lamp was concerned, one had not yet been invented which could be considered thoroughly efficient. The amount of light that could be got from one of these combined incandescent lamps and safety lanterns, was far in excess of that at present enjoyed by miners from any of the forms of safety lamps in use. There would not be the slightest difficulty in arranging matters, so that miners at the working face could have a permanent light of from 5 to 10 candles in one of these lamps; and if they would but compare this with the amounts given in the following table drawn from Dr. Wallace's report on the miners' lanterns at present adopted in this country, they would at once see what a great advantage it would be to be able to use the electric light as far as strength of light was concerned.

Photometric results by Dr. Wallace, F.C.S., &c., of different Coal Miners' Safety Lamps.

	1	2	3	4	5	6	7
	Gauze Lamps.			Clanny.	Davy.	Teale's.	Naked Lamp. Common Colliery Lamp.
	Large.	Medium	Small.				
Illuminating power in standard candles in ordinary condition	·45	·30	·27	·24	·21	·12	1·3
The lamp itself without gauze, &c.	1·37	·93	·75	·51	·58	·61	—
Lamps with gauze, but without glass	—	—	—	—	—	·18	—
Loss of light in ordinary condition, as compared with naked flame = 100	67	68	64	53	64	80	0
Value of light compared with naked flame = 100	33	32	36	47	36	20	100

For the foot of the shaft and ways leading to the same, he thought the incandescent lamp, when fitted with a strong glass cover, was very suitable indeed. It gave little or no trouble; all that was required was simply to turn on the engine driving the dynamo machine in the morning before the men went down to their work and to turn it off again after they came up, and to arrange that the engineman had a look at it and the electrical machine once every two hours or so. At most pits there was plenty of available steam

for driving an extra special engine, and the extra coal required would scarcely be felt. The principal stumbling-block was the first cost; but this was always becoming less, and now it was much less than it was a year ago.

A rough estimate, without taking special circumstances into account, would be for 50 Swan lamps:—

Engine fitted into place complete	£100
Dynamo machine do.	95
One mile of best large leading wire fitted into the mine	90
50 Swan lamps with protecting lanterns complete .	50
Extras, time, &c.	15
	£350

The length of life of these lamps is very promising, as testified by the following table taken from Mr. Gilchrist's report to the Mining Institute of Scotland.

Life of Lamps at Earnock Colliery, December 9th, 1881.

No. of Lamp.	Date when last lamp put in.	Hours been lighted.
1	August 11	1040
2	October 5	560
3	August 11	1040
4	September 7	800
5	September 26	640
6	September 21	680
7	August 11	1040
8	October 11	510
9	September 13	750
10	October 20	430
11	September 7	800
12	October 24	400
13	October 12	500
14	September 7	800
15	August 11	1040
16	November 26	110
17	September 30	600

These lamps are all doing well, and we may therefore hope yet to see incandescent lamps more speedily adopted in mines than hitherto. I shall be glad at any time to answer any queries regarding this mode of lighting ships or mines.

ELECTRIC AND PHOTOMETRIC TESTS OF SWAN'S LAMPS.

Taken at Messrs. R. E. Crompton & Co.'s Testing Room, Queen Street Station, Glasgow, by Andrew Jamieson, C.E., 38, Bath Street. The generator employed was a Bürgin machine made by R. E. Crompton & Co., the total number of lamps in circuit being 52 (13 parallels of 4 in series).

No. of Lamp.	Result Cold by Test Fig. 1. Ohms. (R)	Result Hot. Ohms. (r)	E. M. F. Volts. (E)	Current Ampères. (C)	Candle Power. K	Horse-Power per Lamp. $\frac{E \times C}{746}$	Number of Candles per Horse-Power. $\frac{K \times 746}{E \times C}$	REMARKS.
6 B	76	44	43·6	·99	7	·058	121*	*This lamp is one of a few of those tested that I have tested at low powers.
1	-	28	45	1·6	17	·099	171·7†	† No attempt was made to push the lamps higher, but simply to measure them as they would be under ordinary circumstances.
2	-	22·9	43·5	1·9	18	·11	163·6†	
3	-	30·1	45·2	1·5	20	·090	222·2†	
Mean of 1, 2, & 3,		27	44·56	1·6	18·3	·0996	185·8	

In answer to a question by Mr. Mayer, Mr. JAMIESON said in order to measure the light given by the electric lamps, he made and used a photo-meter on Rumford's principle. The lamps cost 12s. 6d., but renewals were charged only 5s.

Mr. JAMIESON remarked that in the first instance, conductors if properly fitted and proportioned, under the supervision of a skilled professional electrician, were not likely to get broken under ordinary circumstances; should, however, a conductor be broken whilst a current of electricity was passing through it, there would be a spark of short duration. With frictional electricity or electricity of very high tension, such as that produced by a Winters or Holtz machine used for class-room and lecture experiments, incandescent sparks of from four to six inches in length could easily be produced, but fortunately we did not require to use such high tension electricity for electric lighting purposes, and except at the moment of rupture of the conductor, sparks would not take place; in fact, a distance of from $\frac{1}{100}$th to $\frac{1}{10}$th of an inch between the ends of the separated or broken conductor, or the conductor and the side of the ship or other part was sufficient to thoroughly insulate it, and to prevent *continuous* sparks *(if contact was not made and broken between the parts)*. It was, however, well to err on the safe side, and to have the conductors not only well insulated but of larger sectional area than theory demanded, as fires had been caused by using imperfectly insulated wires, as well as wires of too small conductivity, whereby they were liable to become heated (sometimes white hot and even fused.)*

In answer to a question put by Mr. James Gilchrist, as to whether the engine power was in proportion to the number of lamps lighted, Mr. JAMIESON said that in the latest and best systems it was so arranged that, for example, if 100 horse-power were supplying the necessary power for lighting 1,000 incandescent lamps, and that 500 were suddenly switched out of circuit, then the engine power would be automatically reduced to 52 or 53 horse-power for keeping the remaining 500 at the same candle-power as before. This was effected by having a very sensitive engine governor and a certain system of electrical connections in the electric generator, leads, and lamps.

Mr. MAYER said that fully a year ago Sir Wm. Armstrong utilised the power of a little brook that ran near to his house for the purpose of lighting his house with electricity by the Swan lamp. He would like to know if he still continued its use, as he was one of the first to use that lamp, and therefore would be able to tell the length of its life.

Mr. JAMIESON said that four lamps at Earnock had lasted 1,040 hours. Mr. Swan had written to him a few days ago that he was carrying on experiments to determine the life of his lamps when used at full power, and out of 50 lamps only two had gone in 400 hours at full pressure. He ventured to say that all Sir W. Armstrong's lamps had by this time been replaced by better ones, or had been broken; but he could not say for certain.

The PRESIDENT said he had no doubt that they had all listened with very great interest to Mr. Jamieson's paper, and would all agree with him that there was a great future before electricity for lighting purposes. There had been a great many curious and interesting machines exhibited at the recent electric exhibition at Paris, showing how many minds were being brought to bear upon the subject, and how many eminent men had taken it up. He had, therefore, not the slightest doubt but that they would see more of electricity in the near future. There was to be an exhibition at the Crystal Palace next month, so that although this country had done little at Paris, compared with the Continent, he had no doubt that they would show something in London more worthy of the electricians of Great Britain in the way of pushing forward this new lighting power. He proposed a hearty vote of thanks to Mr. Jamieson for his paper.

(Discussion to be continued.)

* Insurance companies would do well to look into this matter, and to have a special set of rules and regulations drawn up on this point. If an electric lighting system was carried out according to proper principles with regard to conductivity and insulation, it should be much safer than a gas, oil, or candle system of lighting, if not it is equally dangerous in its own way.

MILITARY TELEGRAPHS.

THE President of the Society of Telegraph Engineers justly alluded in his inaugural address to the vast opening still existing with regard to that branch of electrical science which was more closely connected with his brother officers than with the members of this society, viz., "the application of electricity to torpedo warfare, and for purposes of military telegraphy." We quite agree with the opinion expressed by the gallant president, that publications and discussions on these subjects have not only rendered valuable assistance to the members of this society, but also to the above branches of the Government service, and hence we venture to think that such discussions would not be objected to from Government quarters. If we glance at the English publications and papers on torpedoes and military telegraphs, we shall find that officers of all ranks have contributed, and not unfrequently with such severe criticism as we should hardly have expected from these quarters. We fully concur with Col. Webber in hoping that the forthcoming session of the Society of Telegraph Engineers may bring us valuable information in this direction. It is a strange fact that English literature on torpedoes is, if not complete, at least exceedingly well represented, but there have been very few papers on this subject; and on the other hand, with regard to military telegraphy, we have had a satisfactory supply of papers, yet there is absolutely nothing in our literature on the latter subject. The following list of books may be not only useful to all interested, but also a stimulus to some military authority to produce a work which may become the text-book of military telegraphy in England, profitable, not only to the student, but also to the officer and man, serving in the British and Colonial armies. This course may serve at the same time to prove more apparently what Professor Abel stated at one of the later meetings of the Society of Telegraph Engineers, and which Col. Webber confirmed in his address, viz., that the science

and application of electricity is more fully developed and utilised in the British army than in any other.

The following list only includes books published since 1869, those of older date may be considered as obsolete:

"La Télégraphie Militaire" de Feodore Fix. Paris, 1869.
Same, translated in German, by C. M. von Weber. Leipzig, 1869.
"Traité de Télégraphie Electrique Militaire" de Floridor Dumas. Paris, 1869.
"Geschichte der Kriegstelegraphie in Preussen." 1854 to 1871, by A. May. Berlin, 1871.
"La Télégraphie appliquée à l'Art Militaire," par N. Naver. Paris, 1871.
"Der Electrische Telegraph für die Armee im Felde," by L. Ulrich and B. Lentgeb. Wien, 1872.
"Etude sur la Télégraphie Miltaire," par Aurèle Guérin. Paris, 1872.
"La Télégraphie Militaire, son rôle pendant le siège de Paris." Projet d'organisation par Paul Ponsrult. Paris, 1872.
"Conférences Militaires Belges, Télégraphie Electrique de Campagne," by Van den Bogaert. Bruxelles, 1873.
"Manuel de Télégraphie," publié par le Ministre de la Marine et des Colonies. Paris, 1875.
"Ante-Projecto de Organisaçao de Telegraphia militar" de Augusto C. Bon de Pousa. Lisbon, 1876.
"L'Electricité appliquée à la Guerre," par Eugène Naves. Paris, 1876.
"Die Kriegstelegraphie," by F. N. Buchholz. Berlin, 1877.
"Le Télégraphe," by Paul Laurencin. Paris, 1877.
"Considerazioni sull' ordinamento del servizio Telegrafico presso gli eserciti," per Giuseppe Donesana. Rome, 1877.
"Die Telegraphen Technik der Praxis im ganzen Umfange," by A. Merling. Hannover (only one chapter relating to military telegraphy), 1879.
"A Manual of Signals for the use of signal officers in the field," by Brig.-General Albert J. Myer. Washington, 1879.
"Annual Report of the Chief Signal Officer to the Secretary of War." Washington, 1879.
"Kriegs Telegraphie," by R. von Fischer-Treuenfeld. Stuttgart, 1879.
"Ueber die Thätigkeit der Feldtelegraphen in den jüngsten Kriegen," by F. H. Buchholtz. Berlin, 1880.
"Tratado de Telegrafia," de Antonia Suarez Saavedra. Madrid, 1880.
"Les Télégraphes," par A. L. Ternant. Paris (only two chapters on military telegraphy), 1881.

PHOTOMETRIC TESTS OF ELECTRIC LAMPS.

IN our issue of January 14th we made a few remarks on the tests made by Mr. Jamieson for ascertaining the candle-power per horse-power of various systems of incandescent electric lamps. A full account of these results, together with Mr. Jamieson's method of finding the resistances of lamps hot and cold, &c., was published, as we stated, in the *Engineer*, of January 6th.

Respecting this subject, and also slightly touching upon the report of Professors Ayrton and Perry on the "efficiency of electric lamps," Mr. Ormiston, the manager of the incandescent department of the British Electric Light Company, has addressed a letter to our above-named contemporary, in which he challenges the results obtained by Mr. Jamieson. This letter read thus:—

PHOTOMETER TESTS OF ELECTRIC LAMPS.

SIR,—Notwithstanding the numerous comments in the various scientific journals on the obvious discrepancy in the results of the tests on electric lamps in the report by Professors Ayrton and Perry, which recently appeared in your pages, and seeing also that Professor Jamieson, on the same subject, in your issue of the 6th inst., has fallen into similar errors, I venture, as no one else has done so, to point out the cause. Some of Messrs Ayrton and Perry's observations are correct, but all of Mr. Jamieson's are wrong, from the simple fact that the resistance *hot* is not correctly got at.

As Mr. Jamieson has given his formulæ and a diagram of connections in his paper, I will deal more particularly with it. All the tests might be taken and worked out correctly as Mr. Jamieson proposes should an ordinary battery or a current from a fed dynamo be used; but when a current from a self-energising machine is employed, both the electromotive force and the current are very materially altered by the varying resistances employed in the testing circuit altering the strength of the magnetic field.

There is no difficulty in getting at correct results whatever the source of the current is; but, as your space is valuable, I need hardly explain how—as any electrician would easily see, I think—now I have pointed out the cause of error. I may mention that the mean resistance hot of this company's lamps, as tested by Mr. Jamieson, should have been about 82 to 83 ohms, with a current of 1 ampère, as against 51 ohms shown in his paper.

Should my explanations not be explicit, I shall be happy to answer any further inquiries.

FRED. ORMISTON, Manager,
Incandescent Department, British Electric Light Company.
Heddon-street, Regent-street, London, W., January 18th.

At first sight it is extremely difficult to understand the meaning conveyed in Mr. Ormiston's letter. Does he wish it to be understood that all Mr. Jamieson's results are erroneous, or only those connected with the observations on the particular system of incandescent lighting by electricity of which he is manager? In commenting upon the somewhat contradictory and confusing epistle, we will take the second paragraph as a starting-point. He there, we presume, intends to imply that Mr. Jamieson's results tested by a certain method could only be right if a battery, or an excited dynamo-machine, had been employed, yet in the succeeding paragraph he states that the source of the current is a matter of indifference, and that whatever it is, correct tests may be obtained without difficulty. Mr. Jamieson probably did not trouble his head about the origin of his current, he was dealing entirely with the lamps, observing the electromotive force between their terminals, and measuring their resistances, hot at the same time, and from this calculating the current strength in amperès. Of course the total result of candles per horse-power depends upon the correct observation of the resistance of each lamp, as this is one of the two factors to be dealt with in finding the current strength. Mr. Jamieson puts the average resistance of the British electric lamps at 50 ohms when giving forth an average light of 10 candles. Mr. Ormiston states that the resistance of these lamps *hot* should be 82 to 83 ohms, but *hot* is a very indefinite term, and until Mr. Ormiston can give us the candle-power he observed when measuring this resistance, and more data to support his statements, we must still keep to the belief that Mr. Jamieson's figures are correct, for though a mistake might occur in dealing with a single test, it seems hardly probable that such an error could happen in an extended series. It would be well to have further explanations on this matter from Mr. Ormiston, and an exhaustive research on such an interesting subject, and from such a well-known electrician, would be of great value to all now engaged in electric lighting.

LEGISLATION FOR CABLE PROPERTY.

THE following is an extract from an article in *L'Electricité* of the 21st January, and contains a translation of the text of a letter from the Minister of Foreign Affairs in France to M. W. de Fonvielle.

"Since our return from England, where we went to study the preparations for the great International Exhibition in the Crystal Palace, we have informed our readers of the great commotion caused on the other side of the Channel by the dangers to which the submarine cables are exposed.

"We have also spoken of the steps taken by the submarine telegraph companies to obtain the protection of the British Government.

"A short account has been given of the reply from the Board of Trade, to the petitioners and also of the excellent article, published in the *Telegraphic Journal and Electrical Review*, of the 15th December, in which public attention is drawn to the most urgent questions which should be discussed in international legislation for cable property.

"We have further expressed our great astonishment on noticing that no official document informed us, that the Minister of Posts and Telegraphs had forwarded to his colleague at the Ministry of Foreign Affairs the result of the resolutions of the Congress of Electricians, as regards the question of cables.

"We feared that the benefit of an initiative taken by Frenchmen should be lost, owing to the administrative routine, which has survived here so many revolutions. But in the knowledge that M. Léon Gambetta is determined to break with the traditions of the past, and to give at last, to our Republic, a Government of labour, justice and progress, we have written, officially, to the Minister of Foreign Affairs the letter which our readers may have seen in our number of the 7th inst.

"Eight days later, we received the answer, which we are now happy to bring before them:

"PARIS, January 11th, 1882.

"SIR,—In a letter dated 7th inst. you did me the honour to consult me upon the question of the protection of submarine cables, telegraph ships, &c., for the purpose of establishing international legislation.

"Since the communications addressed to you by my predecessor on this subject, the question has not been lost sight of. The minister of the postal and telegraphic department brought to my notice the wish expressed by the Congress of Electricians at their sitting of September 28th, and having consulted M. Cochéry, I am about to address to the maritime states a proposal to call together the diplomatic conference for the purpose of settling the different points in international law relating to maritime telegraphy.

"Receive, Sir, the assurance of my sincere consideration,

"For the Minister, President of the Council,
the Under-Secretary of State,
"E. SPULLER.

'In calling the attention of our readers to this highly important document, we would state that we have not thought it advisable to reserve to ourselves the privilege of publishing it, and that we considered the best way of showing our appreciation of its value was to communicate the text to several political daily papers.

"We beg to thank the subscribers and friends who remained true to us, and who have supported us in the crusade which we have carried on alone for such a length of time.

"We hope that, understanding at last the importance of the question of cables, our contemporaries of the scientific and above all of the electrical press, will break that unaccountable silence which they have maintained until to-day, and we will then feel that our strenuous efforts in this direction have borne some useful fruit.

"As we have explained, the question is now entirely out of the hands of M. Cochéry, whose sole connection with the subject will merely be the supply of the necessary technical information.

"M. Léon Gambetta, the Chief of the Cabinet, has taken the matter in hand, and we have no doubt that his well-known energy and anti-conservative principles will lead to a happy solution of the difficulties of this question, which have been so often pointed out by us."

We wish every success to the Conference which the Under-Secretary of State, Mr. Spuller, says it is the intention of the French Government to call together, and we have no doubt that the decisions come to at this Conference will aid materially in securing the non-interruption of the great and useful services which the submarine telegraph cables, now extending all over the face of the Globe, confer on the human race.

NOTES.

CABLE NEWS.—In *El Murcurio* of Valparaiso of the 29th November, 1881, we read that Don J. M. Figueroa, of the Direccion General de Telégrafos de Chili, reports the successful completion of the Chiloë cables, laid on account of the Chilian Government by Mr. E. W. Parsoné, in the ss. *Retriever*, the repairing vessel of the West Coast of America Telegraph Co. The first cable connects Playa Parga with Chacao, the second line being laid between Playa Niebla and Punta Amargo. He also reports the excellent quality of the cable. We also notice that the same paper publishes extracts from information we gave in one of our numbers respecting the Central and South American Telegraph Co.

THE TELEPHONE.—It is said that the solicitors of the United Telephone Company have admitted to the solicitors of Mr. Alexander Maclean (against whom during this week the suit has been proceeding at Edinburgh), that certain claims in the Bell patent December 9, 1876, were published in July, 1876.

NEW TELEPHONE COMPANY.—We hear that it is intended to promote a company to work the United Telephone Company's patents in London (only), the capital to be £2,000,000.

ON SOME CONSEQUENCES OF THE PRINCIPLE OF GAUSS IN ELECTROSTATICS.—By M. Crallebois.—M. Bertrand (*Journal de Physique*, III., p. 74) has deduced from the principle of Gauss several important theorems relating to electrostatics; following in the same course I have obtained certain interesting relations, and, in particular, a simplified demonstration of Clerk Maxwell's theorem.

I. The proposition of Gauss $\Sigma M V' = \Sigma M' V$ is a pure identity if we replace the potentials by the expressions which the definition furnishes. We may arrive at this relation independently of every analytical form ascribed to the function V, by basing upon the notion of electric energy. Let us consider a conductor of the charge, M, with the potential, V, of which the potential energy is

$$\frac{M' V}{2};$$

if we vary the charge from M to M', the potential will vary from V to V' and the increase of energy, equal to the electric work expended, will be

$$(M' - M)\,\frac{V + V'}{2}$$

We have, then, for the final energy, $M'V' = MV + (M' - M)$, $(V - V')$, and after simplification and for a system of conductors, (1), $\Sigma M V' = \Sigma M' V$.

II. From the two members of the equation (1) let us strike out MV and put $M' - M = \mu$, and $V' - V = \mu$, then (2) $\Sigma M \mu = \Sigma V \mu$, or if the simultaneous modification of the charges and potentials is infinitely small, $\Sigma M \delta V = \Sigma V \delta M$, whence follows this theorem as a consequence of the principle of Gauss: "In a fixed system of conductors, if we consider two distinct states of equilibrium, the sum of the products of the initial charge of each conductor, and of the variation of its potential from one state to another, is equal to the sum of the products of the initial potential and of the variation of the charge.

III. When the conductors, kept at constant potentials, are left to their mutual reactions, the energy of the system tends towards a maximum." Clerk Maxwell demonstrated this theorem by the aid of the linear equations between the potentials and the charges. The following process is more direct and rapid. Suppose, at the outset, each conductor, $A_1, A_2, \ldots$ insulated, and let us impress upon the system a deformation infinitely small; the charges, $M_1, M_2, \ldots$ do not change, and for the potentials there are the respective decreases $\delta V_1, \delta V_2, \ldots$ the loss of energy equal to the external work effected is $\delta W = -\frac{1}{2} \Sigma M \delta V$.

The conductors being fixed, let us correct them to constant batteries so as to bring the potentials to their original values; this re-establishment of the potentials cannot take place without the additional charges, $\delta M_1, \delta M_2, \ldots$ regulated by the relation (2). The positive variation of the initial energy will be then—

$$\delta' W = +\frac{1}{2} \Sigma M \delta V,$$

whence we conclude

$$\delta W + \delta' W = 0, \text{ and } \delta' W - \delta W = \Sigma M \delta V.$$

Therefore, 1st, the work effected during displacement by the electric forces is equal to the increase of the energy of the system; 2nd, the energy furnished by the sources is equal to the double of the one and the other of these quantities, and is expended exactly—the half in mechanical work, and the half in electric work or potential energy.—*Comptes Rendus.*

THE ELECTRIC LIGHT AND M. JABLOCHKOFF.—M. Jablochkoff, the inventor of the system of electric lighting now principally used in Paris, has recently received the decoration of the Legion of Honour.

ELECTRIC CONDUCTIVITY OF INSULATORS WHEN HEATED.—By G. Lippmann.—Shellac, gutta-percha, oils of bitter almonds, and turpentine and petroleum were placed between two platinum plates, and introduced along with a capilliary electrometer in the circuit of a battery of 1 to 40 voltaic elements. When the electrometer gave no indication at common temperatures it appeared at higher temperatures (not above 212° F.). On cooling, perfect insulation reappeared. No substance, therefore, appears to be an insulator above a certain temperature.

MICROPHONIC CONTACT IN A VACUUM.—By E. Berliner.—The author is of opinion that the change of thickness and density of the stratum of air between the vibrating contact-electrodes produces the great changes in the resistance. In connection with this is the circumstance that dense carbon does not change its resistance on pressure, so that the resistances of the contacts between the particles of carbon may amount to a megohm. In proof of his supposition the author places in an air-tight wooden box a Blake transmitter, in which a platinum pin lies against a flat metal button fixed in the side of the box, before which a caoutchouc sound-tube is introduced in a depression of the side. The pin and the button are connected with binding screws. The resistance of 5 ohms, or with a contact, of 8 ohms, decreased on discharging by $\frac{3}{10}$ ohm. The loudness of the transmission on introducing the transmitter with a battery into the primary circuit of an inductorium, whose secondary spiral contained a Bell telephone, was not changed on discharging. It is remarked that the varying contact of the carbon may still be here operative. The resistance of the air alone, like that of the luminous arc, must vary inversely as the strength of the current.

RESEARCHES IN LIQUIDS DURING ELECTROLYSIS.—M. Slouguenoff.—On immersing an anode of platinum wire into hydrochloric acid of spec. grav. 1·12, in which the platinum cathode was already present, the author observed the luminous phenomena already described by Fizeau, Foucault, &c. Sometimes an explosion is heard, corresponding to the cessation of the spheroidal state of the wire.—*Wiedemann's Beiblätter.*

INFLUENCE OF THE VOLTAIC ARC UPON SULPHATES OF BARIUM AND CALCIUM.—By F. Jeremin.—The salts were pressed into Jablochkoff candles. The barium sulphate was volatilised, whilst the calcium salt was reduced to the corresponding sulphide. The gases evolved, if passed into potassa lye form, potassium nitrite and nitrate, whilst ozone escapes. *Wiedemann's Beiblätter.*

LECTURE ON INCANDESCENT ELECTRIC LIGHTING.—On Tuesday evening, the 17th inst., Mr. J. Angelo Fahie, C.E., read a paper "On Electric Lighting by Incandescence," before the Royal Society of Dublin. In the course of his communication he mentioned that during the past few years considerable advances had been made in the development and application of electricity for the purposes of lighting streets, railway termini, and other large spaces, and quite recently important experiments had been carried on to show the applicability of this new illuminant to domestic purposes. Lamps may be classed under three separate heads, based and operating on different principles, although receiving their life or electrical energy from the same common source. Under the first head is the "arc" lamp, under the second the "semi-incandescent," and under the third the "incandescent" pure and simple. The first attempt at producing electrical incandescence appears to have been made by a Mr. King, who took out a patent in 1845 for rendering a metallic or carbon conductor, placed in a Torricellian tube, luminous, by passing a current of electricity through it. In 1848 a Mr. Staite carried on experiments to the same effect, using, however, platinum wire instead of carbon, and it is some twenty years since Mr. Swan constructed an electric lamp essentially on the same principle as his recently perfected invention. It was impossible, however, that these early attempts could be attended with success, owing to the difficulty of generating electricity in sufficiently large quantities; but the means now at our disposal for accomplishing this end are so vastly improved by the development of dynamo and magneto machines, that a new starting-point has been given to incandescent lighting, and it is not unreasonable to suppose that at no distant date this system of lighting will compete with gas in economy and efficiency. The several incandescent lamps which have recently been before the public are practically the same in principle, the only difference being in the material used for the carbon, and in the method whereby the carbon ends are secured and the globe sealed. Swan uses cotton thread subjected to an acid solution, as the basis of his carbon. Edison uses bamboo; Lane-Fox, string of flax, or other similar vegetable fibre; while Maxim uses cartridge paper. The process of carbonising the material is almost the same in each case. The filament being first cut to the required dimensions is inserted in a mould, which is placed in a furnace and baked to a very high temperature, after which the filament comes out shaped and carbonised. In the various lamps the length, thickness, and consequently the resistance of the carbons vary. The length is usually from four to six inches. The Edison and Lane-Fox carbons form a simple horse-shoe or loop in shape, while Swan arranges a spiral in his carbon, and Maxim forms a double loop the letter resembling M. The resistance of each lamp depends on the construction of the carbon filament. In the Swan it is about 65, in the Lane-Fox about 40, and in the Edison and Maxim it runs as high as 150 ohms, and the illuminating power usually calculated on is 16 to 20 candles. This point, however, depends on the relative resistance of the carbon and the strength of current sent through it, as the light may be increased or diminished by altering the electromotive force of the current. In order to get a high illuminating power it appears to be only a question of producing a carbon capable of bearing the necessary heat without breaking to raise its intensity to any required power. The average life of the incandescent lamp is stated to be about one thousand hours. A number of lamps placed in one circuit will each emit a light according as the resistance of its carbon is greater or less, therefore it is desirable to have the resistance in each equal—a matter of no small difficulty, seeing the delicate nature of the filament and its liability to breakage

in the process of manufacture. When in action there is very little difference in the behaviour of the various systems of these lamps. The conditions necessary to produce illumination in the one are necessary in the other. They may vary slightly in colour, owing to the nature of the material in the carbon, but there is no question as to the satisfactory results afforded by incandescent illumination. The light is mellow and steady in character, brilliant, yet free from the glare of its bigger brother the arc, clear, yet not trying to the complexion of the fair who may come within range of its influence. It has other advantages, such as reducing the danger of fire to a minimum. We find the Savoy Theatre now illuminated by this means, and the experiment so far is a decided success. As to the question of expense in applying incandescent lighting, it must be borne in mind that the whole system of electric lighting is yet in its infancy, and it would therefore be unfair to enter dogmatically into comparisons between its cost and that of the older established means of lighting by gas. So long as electric lighting is carried out on a small scale and in isolated installations, it will be found difficult to compete with its formidable rival; yet there are many installations in England and abroad where the expense of working compares favourably with that of gas. Lighting by incandescence as a branch of the general system of electric lighting is more expensive than by the arc. It is stated that one horse-power gives ten times more light by the latter than by the former method; but then it should be remembered that the arc light must necessarily be a powerful one, whereas the incandescent lamps may be distributed over a given area, and thus the light placed exactly where it is required. In order to carry out the general application of incandescent lighting to domestic purposes we only want means of generating the current on a sufficiently economical scale, and also of controlling and registering the current as supplied to consumers. These means would doubtless be supplied in time. Already Mr. Swan had devised a meter for measuring the supply of electricity as accurately as the supply of gas now is, and Mr. Edison has invented a method for raising or lowering the intensity of the light, which, however, is rather complicated. The future commercial success of incandescent lighting will depend entirely upon expense, and this will be effected by the life of the lamp, *i.e.*, the length of time it will burn without destruction of carbon; also on the number of lamps or the amount of light given per horse-power. Swan claims ten lamps per horse-power, and alleges that on a thirty miles circuit he can light four hundred of his lamps. He (Mr. Fahie) had gained experience enough to convince him that the system when it could be applied on a large scale would be worked with economy and efficiency, and could not fail to gain in public favour. In conclusion he thought every facility should be given to the development of this new branch of electrical science, for it may yet be the means of conferring benefits on the community which we at present little dream of.

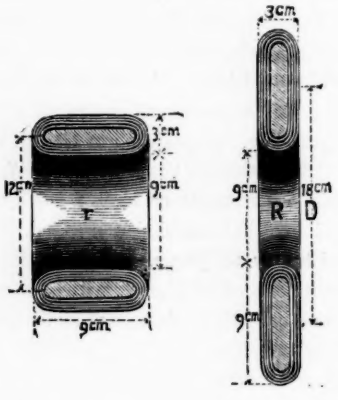
The Rev. Dr. Molloy said it had been established that a yield of 150 candle-light might be expected from every horse-power expended in the steam-engine. Considering the immense convenience, comfort, and beauty of the electric light, it must be considered as an economical light. But as to the general adoption of the incandescent light there were some difficulties in the way. No doubt the wealthy man could introduce it into his residence without difficulty; but when the object was to employ the incandescent light generally it was necessary that it should be produced under such conditions as would enable a public company to supply a current to each householder in such a manner that he could use it to what extent he pleased, at what times he pleased, and under what conditions he pleased (hear, hear). Because there was no doubt that the number of persons using the current would be different at different times. Again, a public company should have some means of measuring how much of the current each person used. But though these problems had not yet been completely solved, it was made clear during the Paris Exhibition that a way had been paved for the solution of them, and he believed the most promising methods were those which had been adopted by Mr. Edison in New York. He had provided means for measuring the current each person used, and for keeping it always in such a condition that each person had exactly as much as he wanted, whether others used the current or not. The means of measurement were ingenious and beautiful, and depended upon the fact that when the current was passed through a solution of sulphate of copper it caused a deposition of the copper proportionate in amount to the energy of the current, the deposition being periodically measured by the agent of the company.

LECTURE ON ELECTRICITY.—Mr. Louis J. Crossley, of Halifax, assisted by Professor Barrett, of Dublin, gave a demonstration of the applicability of electricity at the Victoria Hall, Saltaire. On the afternoon and evening of the 17th, the syllabus of the lecture was as follows:—Sources of electricity and the different methods of production. Heating properties. Fusion of metals, and application of the same for commercial and other purposes. Siemens' electrical furnace. Electric light in a vacuum. Decomposition of carbon producing light. Methods of producing electricity in quantity. Dynamo machines. Different lamps in use in connection with the above. The incandescent systems of Edison, Swan, Maxim, and Lane-Fox. Application of electric lighting for lighthouses. Illustrations of the same on Sir W. Thomson's plan. Siemens' experiments on electro horticulture. Electricity as applied to the transmission of sound, illustrated by music transmitted by telephone. Origin of the telephone. Different descriptions of telephones, with numerous experiments. Hughes' induction balance and audiometer for testing the purity of metals and coins and sensibility of hearing, and the weighing of metals. The transmission of power by electricity. The electro-magnet. Power transmitted by electricity employed to turn a lathe. Electro-magnetic engine. Faure's accumulator was charged with electricity in Halifax, sent to London, and thence to Saltaire to be used. This showed how electricity could be stored for distribution. Children were carried on a Siemens' electrical tramway, which was laid down in the hall for the purpose. The room was lighted by electricity.

The *rôle* of lecturer was filled by Professor Barrett, Mr. Crossley assisting with the experiments, and a scientific entertainment of a singularly interesting character was provided. The Victoria Hall was darkened for the more effective display of the experiments, the means of lighting being provided by electrical lamps upon the Brush principle. The motive power for the electrical machines was supplied

from the engine-room at Saltaire Works. A magnificent collection of apparatus, supplied and fitted up by Mr. Crossley, occupied the front of the orchestra. Along the centre aisle was laid a tramway for the purpose of illustrating the power of Siemens' electro-magnetic engine. Professor Barrett, after alluding to and giving illustrations of the earlier efforts to produce electricity, referred to the great discoveries of Michael Faraday, whom he eulogised as a noble worker, both with head and hand, in the science of electricity. The principle of obtaining the Brush electric light, by which the hall was illuminated, and the various lamps known as Swan's, Edison's, the Maxim, and Lane-Fox's, were exhibited side by side, the series of illustrations culminating in a successful illumination of platinum wire and the application of the electric light to lighthouses. As illustrating the force of electricity, many cargoes of children were despatched along the tramway previously alluded to—an experiment which naturally created much interest. Throughout the period allotted to the lecture, the interest was sustained, and at the close a cordial vote of thanks was passed to Professor Barrett and Mr. Crossley.—*Bradford Observer*, Jan. 18, 1882.

ARMATURES OF DYNAMO MACHINES.—Herr W. E. Fein, writing to a German contemporary, says :—In reference to Herr Schuckert's letter, I find that I must maintain in its full force my former assertion, that "the cylindrical ring of my dynamo-electric machine requires in its working comparatively less power to turn it than a flat ring coiled with wire of the same thickness and length." It stands to reason that by reducing the number of convolutions of the flat ring, the expenditure of power can be made to correspond with that of the cylindrical ring; but the question is, whether after this



diminution the intensity of current is the same as in the more quickly revolving cylindrical ring. In experiments made with two machines, one of which was provided with a flat ring, and the other with a cylindrical ring, but which were alike in all other respects, I found that even with the same number of convolutions in the two rings, the intensity of current was greater in the cylindrical ring. It has this fact also in its favour, that not only the speed of the respective wires, but also the more or less sudden change of polarity in the ring, exercises a considerable influence upon the intensity of the current.

What great difference, however, results in the number of turns of both rings, when they are to be driven at the same expense of power, the following example may illustrate (explain), when, to simplify matters, the magnetic friction was not even taken into account, which, when the intensity is the same, acts the stronger as a brake on the ring the larger its diameter. In the following sketch R represents the flat ring, and *r* the cylindrical ring, in such proportionate sizes, which are obtained, when for both rings the same number and length of the winding wire be taken. From the dimensions which have only been given by way of an example, we obtain when the mean diameter, *d*, of the ring, *r*, be = 12$^{c\,m}$, for the mean diameter, D, of the flat ring, R, a length of 18$^{c\,m}$. Let us now suppose the first makes 1000 revolutions per minute, then the mean speed of each single turn of the wire per minute : = 12 × 3·14 × 1000 = 37680$^{c\,m}$. For the same expense of power the mean speed of each turn of the wire of the flat ring, R, now also should travel over a distance of 37680$^{c\,m}$ per minute, and we obtain then as number of turns for the same time $\frac{37680}{18\times3\cdot14} = 666$ Should Mr. Schuckert's opinion now be right, then the flat ring with a number of revolutions of 666 per minute ought to produce a current of the same intensity as the cylindrical ring with 1000.

THE TELEPHONE COMPANIES AND THE DUNDEE HOUSE FACTORS.—Some time ago an application was made by the House Factors Associations of Dundee to the National Telephone Company and the Dundee and District Telephone Company, for increased remuneration for the liberty of fixing their wires upon house property. The payment has been one shilling hitherto, for the wires put on any house. This sum is considered inadequate to repair the damage done by the wires, and the sum of 10/- for the first wire, and 5/- for each additional wire is demanded. At a meeting of the association, held on the 19th inst., a letter from the representatives of the two companies was read, stating that a reply could not be given to the request until after the meetings of the respective companies in February next. It was consequently agreed to adjourn till after the meetings were held.

TELEGRAPH LINES IN THE WORLD.—In a paper contributed to the *Zeitschrift d. Statischen Bureaus*, Herr Carl Brämer gives the following valuable statistics on the Telegraph lines of the world for 1879, in kilometres :—

	Length of lines.	Length of wire.
German Empire	66,855	238,426
Austria	34,626	90,999
Hungary	14,502	52,918
Russia	88,587	204,634
Sweden	11,304	29,026
Norway	8,610	15,756
Denmark	3,448	9,118
Great Britain	41,311	183,815
Netherlands	3,761	13,655
Belgium	5,410	23,572
Switzerland	6,552	16,007
France	64,275	182,518
Spain	15,870	40,053
Italy	25,533	84,101
Greece	3,518	4,515
Bulgaria	2,057	3,021
Roumania	5,239	8,324
Algeria and Tunis	6,984	10,059
India-European Line	3,528	9,276
British India	33,040	83,600
Dutch Indies	5,861	7,413
Cochin China	1,634	1,669
Japan	6,380	14,260
Western Union	137,803	375,556
Victoria	5,151	9,289
New Zealand	5,858	15,028
Total	615,682	1,739,953

A kilometre being equal to 0·62,137 mile, the total length of miles would be equal to 382,566, and the total length of

wire equal to 1,081,155 miles. It will be noticed that for the United States the Western Union only is given, that of Mexico and the whole of South America is omitted. These official figures are supplemented by Herr Brämer, as follows :—

	Length of lines.	Length of wire.
Luxemburg (1877)	310	527
Portugal	4,253	9,719
Montenegro	444	...
Servia (1874)	1,461	2,416
Turkey	27,497	52,142
Senegambia	415	415
Cape Colony	2,543	3,101
Orange Free State	441	...
Persia	3,426	4,485
Ceylon	1,308	...
Phillipine Islands...	1,200	1,500
Canada (1877)	17,694	26,142
United States (1877)	177,000	388,000
Mexico	11,997	...
Guatemala...	1,867	...
Honduras	1,046	...
Costa Rica...	320	...
Cuba	4,500	...
Porto Rico...	750	...
Venezuela	539	...
Colombia (1876)	2,960	...
Ecuador (1875)	338	...
Peru (1875)	978	...
Bolivia (1875)	762	...
Paraguay	72	...
Brazil	6,942	...
Uruguay	1,219	...
Argentine Republic	7,757	15,819
Chili	7,162	...
West Australia	2,496	2,532
South Australia	7,070	9,500
Queensland	9,608	12,860
New South Wales	12,099	19,998
Tasmania	1,175	1,475
New Caledonia	1,040	1,104
Sandwich Islands...	64	...

His estimate is as follows :—

	Lines.	Wire.
Europe	407,950	1,213,400
Africa	18,400	27,400
Asia	83,900	175,700
America	243,700	490,000
Australasia	44,350	65,500
Total	798,300	1,972,000

In 1879, therefore, the total miles of line were 494,000, and the total miles of wire 1,225,000.

In addition to this are the submarine cables, a list of which to December 31st, 1880, is given below :—

Anglo-American	12,319 miles.
Black Sea	403 ,,
Brazilian Submarine...	4,227 ,,
Cuba Submarine	1,068 ,,
Direct Spanish	931 ,,
Direct United States	3,438 ,,
Eastern	18,888 ,,
Eastern and South Africa	4,441 ,,
Eastern Extension	12,022 ,,
German Union	258 ,,
Great Western	5,590 ,,
Mediterranean Extension	235 ,,
Mediterranean and Brazilian	230 ,,
Plantino-Brazileira	1,219 ,,
Submarine	702 ,,
West Indian and Panama	4,689 ,,
Western and Brazilian	2,901 ,,
Total	73,562 ,,

FIRES IN THEATRES.—The *Journal de Saint Petersbourg*, of the 7th Dec. (19th) last, calls attention to a work, issued about four years ago, by M. Auguste Felsch, in which he states that up to the date of the issue of his publication 252 cases of destruction of theatres by fire had occurred. According to his calculations, a theatre or concert-hall only lasts on an average of 22 years, and is then destroyed by fire. Of the above-mentioned 252 theatres, 5 were burned before they were opened for performances; and 70 only lasted five years; 38 attained their tenth year; 45 the twentieth; 27 the thirtieth; 12 the fortieth; 20 the fiftieth; 17 the sixtieth; 7 only lasted eighty years; 8 lasted one hundred; and 3 only exceeded that age. Thirty-seven places of amusement were burned twice, 8 of the largest theatres three times, and 4 four times, 1, the National Theatre at Washington, five times. Taking each country separately, it appears that there have been 176 theatres burned in America, 68 in England, 63 in France, 49 in Germany, 45 in Italy, 26 in Austro-Hungary, 24 in Russia, and 17 in Spain and Portugal. The number of lives which have been lost has been enormous. From a table showing the number of persons who have been killed or injured at the principal fires, it appears, taking an example here and there, that in the year 1794, at Capo d'Istria, 1,000 people lost their lives; in 1836, at St. Petersburg, 800; in 1845, at Canton, 1,700 were killed, and 1,670 injured; in 1846, at Quebec, 200 killed; in 1872, at Tien Tsin, 600; and in 1877, the latest year for which any figures are given, 400 were killed at Montpellier.—*Society of Arts Journal.*

CORRESPONDENCE.

THE INVENTION OF THE SPEAKING TELEPHONE.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—I herewith send you a copy of a patent for telephone receiver and transmitter issued to J. W. McDonough. on August 9th, 1881, on specifications and drawings published in United States Patent Office, April 10th, 1876.

You will see that this patent claims a plate capable of being attracted by a magnet—and in close proximity thereto. In reference to Bell's patent, Dec. 9, 1876, you will find a claim for this precise arrangement. Bell's United States patent was filed January, 1877, and his English patent December, 1876. It may be asked to whom does the honour of the invention (of late years) of the telephone belong.

W. C. BARNEY.

[We herewith reprint the claims from the specifications of W. McDonough's United States patent, for which application was filed April 10th, 1876, and likewise give illustrations of figures 1 and 2 from said specifications.—ED. ELECTRICAL REVIEW.]

What I do claim in this division as part of my whole invention, and desire to secure by letters patent, is—

The combination, substantially as hereinbefore set forth, for a telephone receiving apparatus, of a helix, and magnet, and connecting-posts to which the wires of the helix are joined, mounted in one end of a frame or holder of wood or such like insulating material; a membrane mounted on the opposite end of said frame or holder, a portion of the face of which membrane presents a material attached to and supported wholly thereby, capable of being attracted by the

FIG. 1.

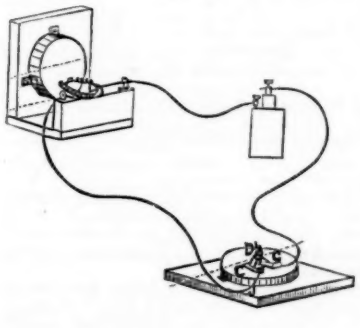
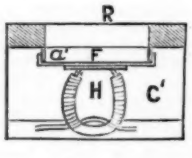


FIG. 2.



magnet and in close proximity thereto, so that the said membrane shall be caused to vibrate by the action of pulsations in an electric current in the helix around the magnet, with a sound-recess at the opposite side of the membrane from the magnet to confine the sounds received therein and exclude exterior sounds from the ear of the listener, and adapted at the same time to allow the ear of the listener to be placed in close proximity to the membrane, all constructed and arranged to operate substantially in the manner described.

JAMES W. McDONOUGH.

PROCEEDINGS OF SOCIETIES.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

AN ordinary general meeting of this Society was held on Thursday evening, January 19th, at the Institution of Civil Engineers, under the presidency of Professor G. C. FOSTER, F.R.S. The minutes of the previous meeting were read and confirmed, and the names of several new candidates announced. Professar FOSTER then moved the following resolution, which he prefaced in appropriate terms: "That the council received with much regret the announcement of the recent death of Mr. L. Schwendler, and cannot allow the occasion of the first meeting of the Society to pass without expressing their sorrow at the loss of so distinguished an electrician, and such an active member of the Society." Professor FOSTER further announced that Mr. Symonds of the Meteorological Society had made the Society a very valuable present of books upon atmospheric electricity, and for that present a vote of thanks to Mr. Symonds was passed. Professor FOSTER then announced that the remaining duty of his term of office was to make way for his successor, and he did so by vacating the chair, which was taken by the President-elect for the ensuing year, Lieut.-Col. C. E. WEBBER, R.E., who passed a hearty vote of thanks to his predecessor, and proceeded to deliver his

INAUGURAL ADDRESS,

of which the following is an abstract.

Lieut.-Col. WEBBER, R.E., said that the fact that the Society had passed out of its first decade of existence, and was in the second year of its next decade, was one of great interest to those, of whom he himself was one, who had been connected with it since its original formation, and was sufficient apology for indulging in a few mutual congratulations while he took stock of the present and future position of the Society. He was unconscious of any special merit which he possessed that led to his election as President, and was encouraged in the responsibility of the position by the reflection that a name so humble as his own should have been placed upon the roll of his illustrious predecessors. His past actions in the early days of the Society, when Lieut.-Col. Bolton, Dr. Siemens, Mr. Sabine, and himself laboured so much in its formation, was, he thought, the reason for the honour of his election as President. But few people knew of the early struggles of the Society, the conception of which was due to Mr. Sabine, who had already started the idea of an Electrical Society. In the year 1870, the star of telegraphy was in the ascendant, and the extension of it by the purchase of the government of the public telegraphs then existing caused the name of telegraph engineer to come to the front, and it was then that the Society was promulgated. Its body comprised comrades in government employment, in railway and private companies, in manufacturing and supplying firms, in foreign administrators, and some of the most eminent scientists at home and abroad. The first principle of the Society was liberality in its widest sense, and to that principle the success of the Society was due (though its title apparently tended to exclusion); for the desire was to secure the adhesion of all persons scientifically and practically connected with electricity, and the practical tone of discussion adopted at the meetings greatly furthered that desire. Trade depression was to an extent brought about by the monopoly of the telegraphs by the State, and that hampered the duty of the Society in regard to keeping alive the interest in electrical matters. But the Post Office became a large consumer of telegraph material supplied by outside traders, and submarine telegraphy was extended as internal telegraph arrangements were facilitated.

The deliberations of the Society had not failed to benefit the State telegraphs for experiences gained in the public service were narrated at its meetings, and their ventilation resulted in practical knowledge useful to all. In regard to inventions, great responsibility rested with telegraph administrations in fathering particular productions, for once pledged to a particular invention, they were slow to admit an entire or partial failure of it.

In several countries, persons high in authority, but without practical knowledge, had been fascinated by particular inventions, the adoption of which crippled the future operations of their administrations. Parsimony also in an administration was to be deprecated as, by it, valuable improvements might be lost or postponed for want of wise expenditure.

There was no need for international competition for efficiency in telegraphy as in artillery. Each country had to study the needs of its own people, and meet them as economically as possible, and what suited one country was discarded by another, as instanced in the employment of the Hughes' type instrument. To supply type printed telegrams in England would be fatal to any reduction of price, and the Postmaster-General was well advised when he abandoned the use of the type instrument. In countries ruled by "bureaucracy" such instruments could be used on first and second class lines, but the British public required the same service all round.

Technical societies were better able to give opinions upon points such as the general applicability of an instrument than were international exhibitions, for in the latter case, few visitors were capable of appreciating exhibits, and were led away by reports in favour of one or other invention more dependent upon its manner of exhibit than its practical value. It was to be feared that the work of juries was rather unpractical, and that view was not altogether underserved, for the work was sometimes of so difficult a nature that it was not unfair to doubt their power of discrimination. If the deliberations of the recent jury convened at Paris were made public, it would be found that foregone conclusions had been adhered to in the face of adverse argument. Those remarks were not made in deprecation of the patriotic Englishmen who were on the jury, but was based upon his experience gained in 1878. The Society took upon itself burdens in favour of the Telegraph Department, which in France were borne by the Minister of Posts and Telegraphs, and where pecuniary assistance, and full publicity were given to every one who introduced an improvement. The judicious dispensing of such encouragement did not leave persons without hope that their efforts would be recognised, and though absent (no doubt conveniently so) in England, men anxious to shine joined the Society, and were induced by it to give full publicity to all their ideas.

The number of naval and military officers in the Society increased rapidly, and the application of electricity to the purposes of those forces had been the frequent subject of discourse, but the warlike application of electricity in the use of the torpedo, had never been described before the Society. Those who possessed information on the subject felt that publicity would be detrimental, but perhaps their enforced silence would soon be broken and papers given both on home and foreign submarine systems.

Knowledge as to the effect of the effort of submarine explosions was limited at the present day and would be assisted by the invention of an electrical instrument which would indicate the vibration of the mass disturbed.

The Society had endeavoured to bring into one association all men having a common object, ready to learn and impart knowledge, and the only qualification for membership was a knowledge of the meaning of the wonderful agent employed, which qualification was as wide as the field of application of electricity, which embraced all nature. In that field existed the medical profession, and members of that body should be induced to join the Society that their knowledge in the curative applications and principles of electricity might be perhaps increased, for the day was approaching when the study of electricity in its physiological functions would be of paramount importance to medical men.

The electrical congress at Paris had initated the practice, and the publication of its reports might further the idea suggested and result in the production of papers on electro-physiology. Dr. Stone had recently given a paper before the British Association on the use of the continuous current for diabetes which would have been a suitable paper for discussion at a meeting of the Society.

The historical collection of apparatus at the Paris Exhibition probably included everything of the kind which Europe could produce. The Pacinotti ring, in the Italian section, reminded the army of inventors how long ago the birth of the present form of continuous current motors took place. The explanation of the Pacinotti ring given by Professor Govi at a meeting of the Society in Paris was a memorable event.

In 1842 Dr. Gloesner described an oscillating and rotary electromotor and the manuscript was exhibited in the Belgian historical collection. The Congress did honour to Dr. Gloesner by the admission of his daughter as the only lady member. The advantages of the double current system of telegraphic transmission, which had been turned to such good account by Mr. Cromwell Varley, were discovered by Gloesner in 1837, of which ample proof existed in original manuscript, and indeed authenticated manuscripts in the possession of public bodies proved that hardly any present application in telegraphy and dynamo electricity was not described or foreshadowed by Gloesner.

In reference to the report of the Lightning Rod Conference, recently issued, it was a matter of gratification that half of the total number of delegates—twelve—six were members of the Society. Nineteen pages of that report clearly defined the laws and features of lightning conductors, and all the laws laid down were equally applicable to all climates.

The International Electric Congress, held in Paris last September, was a distinguishing feature of the year 1881. Headed by the Minister of Posts and Telegraphs in France, the total number of delegates drawn from all nations were 241. Great weight was given to the project by the decree for its being held receiving the signature of the President of the French Republic and other magnates. A full list of the delegates was issued by the scientific press some time ago. The Congress opened on the 15th September, and was divided into three groups, each of which discussed matters of detail and referred more important points to a joint sub-committee represented by members from each group, and resolutions were afterwards submitted to the decision of the full Congress. With the exception of the day set apart as a tribute to the memory of President Garfield, the Congress, entire or in groups, sat three times a day till the completion of its labours on the 5th October. One point discussed was whether the Congress should express an opinion as to danger from lightning caused by telegraph and telephone lines being attached to buildings. Professor Helmholtz, Sir Wm. Thomson, and others took part in the discussion. Theory urged the danger of damage to property near the wires or instruments inside buildings, while practice claimed immunity from such damage by the very presence of such materials, and in England practice would be supported as it was more extended there than on the Continent. Ultimately the Congress declined to give any opinion on the point. The importance to electro-biology and therapeutics of uniform standards of measurement was instanced to the Electrical Unit Commission. That Commission consisted of thirty-one of the most notable electricians of Europe, and it adopted the four important resolutions which were announced in the Press. The task of deciding the length of the column of mercury, the resistance of which with a sectional area equal to one millimetre, at a temperature of zero centigrade, should represent the unit of resistance, an ohm, was left for an International Commission. The phenomena of earth and atmospheric currents formed another subject of discussion, and statistics were suggested to be given of observations taken over an area not less than the Continent. The French Government undertook to move in the matter so that a permanent International Congress could be appointed.

For a universal wire gauge the Congress adopted the millimetre, and Lieut.-Col. WEBBER suggested that the announcement should have the effect of inducing telegraph engineers to gradually cease to use

the Birmingham and other gauges in favour of the millimetre in their specifications.

The yield of gutta-percha for insulating purposes was discussed at the Congress, and it was shown that the demand for gutta-percha on account of electric lighting alone had caused a great rise in the price of best gums. One French cable manufacturing firm obtained a concession, and planted a great portion of a French colony with india-rubber trees, but found that they could not carry it on with success owing to their inability to prevent the natives trespassing in search of the product. Lieut.-Col. WEBBER suggested that a board of control representing the great consumers would be useful in protecting such an important industry; or at any rate the offer of a prize for the best essay on the history and cultivation of the raw material of gutta-percha, and other congenital gums, together with particulars of the sorts offered for sale in various markets, and the probability of the future supply continuing, might do good.

A new dielectric had lately been introduced, called insulite, a material produced by the thorough desiccation of vegetable fibre, which was afterwards impregnated with paraffin and possessed great resistance to the passage of electricity with the pliability of gutta-percha, and the hardness of ebonite.

The rights of companies having cables along or near the same track was also discussed by the Congress. The absence of security in proportion to the value of the property concerned on the ocean bed was pointed out, and the difficulties that might arise if Germany laid a cable westward along the English Channel, and across the ten cables at present laid, were referred to. The subject being of an international character was set aside for the consideration of the projected International Conference; but in the meantime Col. WEBBER suggested that a committee, appointed by the Society, would do good in formulating the case for the United Kingdom, which had greatest interest in the matter.

In consideration of electric photometrical measurement there was much division of opinion at the Congress. The standard of the Carcel lamp was favoured by the French, while the opposite section sided with the candle. Both standards had been sufficient for comparison with gas, but the electric light was so intense that they each proved inadequate. It was conceded to the French that pending the formation of the International Commission the Carcel lamp should be used, and that was the standard adopted by the jury of the Electric Exhibition. In England and Germany the term "candle" as a measurement of light was old-established, and had become a familiar expression, and candle-power for light, like horse-power for steam, would be difficult to eradicate. A committee on Photometric Standards, appointed by the Board of Trade, had found a percentage of difference in the illuminating power of a large quantity of standard candles, recommended the use of the sperm candle for determining the illuminating power of coal gas to be discontinued, and Harcourt's air gas flame to be used instead. Mr. Harcourt's unit of light for photometry was described before the British Association in 1877, and his air gas was described as a mixture of 560 volumes of air with one of standard petroleum. Lieut.-Col. WEBBER gave details of the production of the air gas to show that the proposal approached as perfect a fundamental unit for the measurement of light power as could be expected. But with the introduction of the electric light, to a great extent, the hydro-carbon standard of measurement must disappear, and it was hoped that the question of a proper standard would soon be discussed by the Society.

The change in the title of the Society by the addition of the words, "and of Electricians," was a necessity and the result of much deliberation on the part of the council. Another title might have been selected; but that in existence was an old one, and could not be overthrown, and the best addition was perhaps that made, which covered a large field. On the continent the term "electrician" was in common use, but in America it was applied to all such as were called engineers in England.

Exhibitions were useful as stimulants. They scattered good seed of all kinds in the minds of men, and the fruits were to be gathered by such bodies as the Society. The oppportunities of doing so were many, and the ways of receiving benefit from using them were equally numerous. The influence of the Society might grow and its numbers increase, which would improve its financial condition and enable it to extend its field of labour, its authority might be more fully recognised, which might lead to its being looked to as the tribunal before which worthiness of work could be judged. The membership of the society might grow in public esteem, which would cause it to become the best means of establishing the reputation of real workers, and the rejection of all others. Before those ends could be attained there was plenty of work by the way.

Education was the foremost work of the Society. All society was stirred up by the current educational movement, and technical education possessed the greatest attraction for the Society of Telegraph Engineers. The supply of the City of London Guilds merely increased the demand, and probably Professor Ayrton would shortly favour the Society with an account of that institution. Technical journals and magazines increased, which proved the demand for scientific information. In the subjects of magnetism and electricity under the Science and Art Department (examiners, Professors Guthrie and G. Carey Foster) the numbers examined had increased from 728 in 1867 to 10,432 in 1877, and the payments on results in 1880 amounted to £7,300.

The number of persons employed or interested in works dealing with electricity had more than doubled in the past three years (without Government employés being reckoned), and the public interest in the same period had increased tenfold. Such facts were sufficient to show that the opportunity existed for the Society to lay the foundation of an electrical institution for training and examinination of the rising generation. The Society was not too young to take upon itself the formation of such an institution, and, in fact, by its class of students, had already initiated the system. But the class of students was in name only, for no means were provided by the Society by which they could carry on their studies, and no means existed anywhere to enable a student of electrical science, at a moderate cost, to obtain good practical instruction in the countless branches of the science. The Paris Exhibition might be called the cradle of electricity, because it was the first means by which general public attention had been drawn to the science, and conveyed much instruction to the uninitiated. No programme or curriculum of examination had been laid down, to pass which would qualify a man to be designated an electrician, which was probably due to the rapid development of the science, which, though full of snares, was taken up frequently by people possessing less knowledge than courage. It was only after long practice in the subject that explorers appreciated their work. In the institution suggested, practice should take precedence of theory with some investigations, and *vice versâ* with others, by which plan the maximum benefit would be given. Fostered by the Society, such an institution would have every chance of success, and the inevitable "rocks ahead" could be best steered clear of by its aid. One of them, "trades-unionism," had been disbanded, in regard to electricity, by the freedom of discussion encouraged by the Society; and that was instanced at the Paris Exhibition, where inventors threw away all reserve and imparted all the information possible. That led him to the Patent Bill, under discussion by the Society of Arts, and which deserved encouragement from all other scientific societies. Lieut.-Col. WEBBER closely watched all the movements of the Bill, and he intended to give the Telegraph Engineers Society the benefit of any knowledge he obtained. Such a Bill might prevent the trafficking in patents which so often prevented the public from receiving the full benefit of an invention. The ignorance of the public in regard to inventions was traded upon by the speculative portion of the community, who caused fluctuations in the market for reasons which an educated public would consider groundless, unless it was carried away by the temporary excitement which often ushered in a new invention. On the contrary, it was a pleasure to refer to the commendable generosity of Professor Hughes, who gave the public the full benefit of his microphone, unfettered by patent rights, as also his induction balance, for locating bullets in wounded soldiers. It was not a common characteristic for men to come to the front, indifferent to diplomas and decorations, for the disinterested benefit of the general community; but many hard-working members of the Society were ready to come forward to the aid of an institution which would promote the knowledge of electrical engineering.

The day was probably not far distant when all the phenomena of nature could be ascribed to one agent, that of electricity, which, as at present known, manifested its presence by motion, heat, and light. Professor Perry had prognosticated that before long every function and want of daily life and labour would be aided by electricity; and the men most likely to assist in such a millennium being reached were to be found among the ranks of those who comprised the Society of Telegraph Engineers, which in its proper field embraced all the investigators and practical workers in the domain of electric science.

A resolution was then proposed by Mr. H. C. FORDE, and seconded by Mr. C. E. SPAGNOLETTI, that the best thanks of the Society be given to the gallant president for this paper, which was carried unanimously, and the meeting adjourned until Thursday, February 9th, when a paper on the Pilsen electric light was announced to be given by Mr. Joel.

NEW PATENTS—1882.

173. "Improved means and apparatus for producing (automatically) signals and alarum sounds in dwelling houses and other buildings, in cases of fire or other causes." C. B. CRISP. Dated Jan. 12.

178. "Railway signalling." C. E. SPAGNOLETTI. Dated Jan. 12.

198. "Improvements in electric block signals and electric locking apparatus for levers working semaphores and points on railways, the latter part of such improvements being applicable to the secure closing of buildings, store-rooms and safes." J. RADCLIFFE. Dated Jan. 13.

252. "Electrical accumulators or secondary batteries." H. H. LAKE. (Communicated by La Société Universelle d'Electricité, Tommasi.) Dated Jan. 18.

289. "Secondary batteries for the storage of electricity." J. HUMPHRYS. Dated Jan. 20.

290 "A new and improved application of telephonic conductors and apparatus therefor." H. J. HADDAN. (Communicated by J. D. Morel.) Dated Jan. 20.

291. "Apparatus for recording speech." H. J. HADDAN. (Communicated by J. D. Morel.) Dated Jan. 20.

297. "Improvements in galvanic batteries, and in the treatment of solutions therefrom, for the recovery of useful products." J. and A. J. HIGGINS. Dated Jan. 20.

300. "Fire extinguishing and alarm apparatus for use in theatres and other buildings." W. R. LAKE. (Communicated by H. S. Maxim.) Dated Jan. 20.

302. "Voltaic batteries." A. R. BENNETT. Dated Jan. 21.

305. "Electric lamps." J. N. ARONSON. Dated Jan. 21.

316. "Telephone transmitters." E. G. BREWER. (Communicated by J. Olmsted.) Dated Jan. 21.

319. "Construction of secondary batteries.' J. S. SELLON. Dated Jan. 21.

329. "Telephone transmitters." S. P. THOMPSON. Dated Jan. 23.

333. "Electric cables." T. J. HANDFORD. (Communicated by P. B. Delany.) Dated Jan. 23.

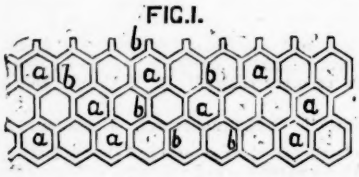
339. "Improvements in regulating electric lamps, and in apparatus specially devised for the purpose." E. de BASS. (Communicated by B. Abdank, *alias* Abakanowicz.) Dated Jan. 23.

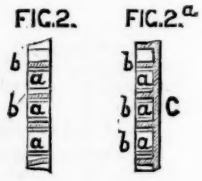
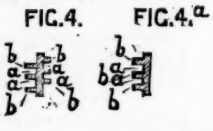
ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

2264. "Cables or conductors for electrical circuits." W. C. BARNEY. Dated May 24. 4d. According to this invention the conductor is covered with any good insulating material; outside of this insulating material is a metallic cover, which may be a tube or close spires of wire or tape, extending throughout the entire length of the conductor, carefully protected from contact with the inclosed conductor or with the earth, and supported on insulators in the same manner as ordinary telegraph conductors. (*Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.*)

2265. "Telephone transmitting apparatus." J. T. GENT and H. G. ELLERY. Dated May 24. 6d. Relates to improvements in telephone transmitting apparatus, and has for its object a simple mode of increasing the sounds and rendering the articulations more clear and distinct when used for communicating between distant stations. In carrying out this invention, the inventors make use of a thin plate or diaphragm of wood, which is attached to the outside cover of the case containing the apparatus, and placed a short distance from the same, the cover having an opening in the centre through which the sounds or messages are received upon the diaphragm. Thin plates of carbon are fixed side by side across and attached to the diaphragm, the plates being near each other, but not in contact. Brackets are attached, carrying bars of metal, on which are loosely hung metal arms, each arm carrying a plug of prepared carbon, these again resting on or against the carbon plates. Twelve to sixteen of these arms are used, and carbon plugs, arranged in series of three or four, so that a current of electricity to traverse the whole must pass over successive sets. Each arm, either suspended in a vertical or horizontal position, is provided with an adjustable weight on a screw threaded arm, so that by moving the said weight nearer or further from the centre of suspension the prepared carbon plugs will rest with greater or less weight against the carbon plates attached to the diaphragm.

2272. "Secondary batteries or apparatus for storing or conserving electricity." J. W. SWAN. Dated May 24. 4d. Has for its object the facilitating the construction of so-called secondary voltaic piles, and aims at the production of plates having surfaces suitable for holding spongy lead, or lead in a finely divided form. Figs. 1 and 2 are respectively a front elevation and transverse vertical section of a cellular plate; and figs. 3 and 4 are respectively a front elevation and transverse vertical section of a corrugated or grooved plate; figs. 2^a and 4^a illustrate modifications of the plates shown in figs. 1 and 2, and figs. 3 and 4 respectively. The plate shown in figs. 1





and 2 is constructed with cells or cavities, *a*, for the reception and retention of spongy lead, or lead in a finely divided form, and the outer surfaces of the walls, *b*, of the cells may also be covered or coated with the spongy or finely divided lead. The cells may be closed on one side, as shown at *c*, in fig. 2^a. The plate shown in figs. 3 and 4 is constructed with grooves, *a*, to be filled with spongy lead, or lead in a finely divided condition, and the outer surfaces of the ridges, *b*, may also be covered or coated with lead in that condition. The ridges may be formed on one side only of the plate, as shown in fig. 4^a.

2304. "Manufacture of apparatus for the exhibition of electric light." WILLIAM CROOKES, F.R.S. Dated May 25. 2d. Has for its object improvements in the manufacture of incandescent lamps. Paper or like material from which the carbon filament is to be produced, is treated with hydrofluoric acid to remove impurities. A strip of the paper is then connected with the conductors by binding it with fine wire. The strip is then carbonised by heat in an atmosphere free from oxygen, by preference a hydro-carbon vapour. Finally the connections are immersed in a depositing cell charged with sulphate of copper solution, and a deposit of metal produced thereon in the usual manner. The parts of the conductors which are not required to be coated may be protected with wax or other like covering, and the part of the carbon filament which should remain uncoated is supported so as to prevent it entering the metallic solution in the cell. (*Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.*)

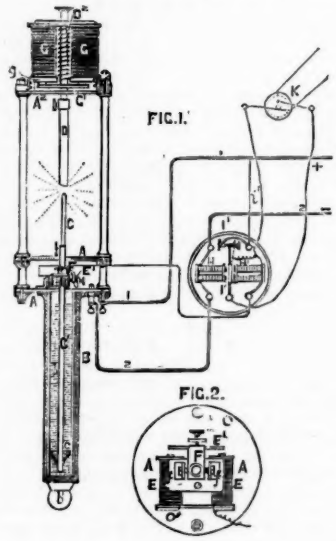
2331. "Hydraulic telegraph." COMTE CHARLES DE MONTBLANC and LUCIEN GAULARD. Dated May 27. 2d. Consists in working despatch tubes by water instead of pneumatic pressure. (*Provisional protection.*)

2344. "Electrical lighting apparatus." PAUL L. M. GADOT. Dated May 27. 8d. Relates to the automatic switching of the current from one Jablochkoff candle to the other as each is consumed or becomes defective.

2369. "Electric lamp, &c." S. COHNE. Dated May 30. 4d. Hitherto the light of electric lamps in use is subject to great unsteadiness from flickering, caused mainly by their complicated construction, which prevents the electro-magnet from maintaining the current at the same intensity throughout, and consequently the arc cannot keep the same constant light. The object of this invention is to produce a steady burning arc lamp of a simple construction, based on hydrostatic principles, so as to reduce the cost much below that of other lamps in use.

2375. "Magneto-electric machines, &c." H. E. NEWTON. (A communication from abroad by C. A. Hussey and A. S. Dodd, of New York.) Dated May 31. 6d. The improvements consist chiefly in a continuous or endless permanent magnet of internally circular or analogous form provided with poles of consequent points.

2402. "Electric lamps." G. HAWKES and R. BOWMAN. Dated May 31. 8d. Relates to the construction of electric lamps of the arc system in which the lower carbons are buoyed up by mercury, and are checked in their rise by an oscillating gripping piece operated by an electro-magnet. Fig. 1 shows the lamp in partial sectional elevation, and fig. 2 is a plain view on an enlarged scale of the same, the upper part of the lamp being removed. The frame of the lamp consists of three metal plates, A, A^1, A^2, secured together by vertical columns, but insulated therefrom. Pendent from the plate, A, is a metal tube, B, which is fitted with a glass lining containing mercury, *b*, in which the lower carbon holder is immersed. The glass tubular lining is closed at bottom by a metal plug b^1, which presses the glass lining into contact with the plate, A, in the act of securing a fluid tight junction at the bottom of the tube. C is the lower carbon, and D the upper carbon The lower carbon, C, in rising through an opening in the plate, A, passes between the arms of an electro-magnet, E, fitted to the plate, A, and also through a gripping piece, F, which is pivoted at right angles to the magnet, and is carried by



brackets, *f*, secured to the plate, A. Attached to this gripping piece is the armature, E^1, of the magnet, E, the attracting power of which will rock the piece, F, and cause it to grip the carbon, C. So soon, however, as the armature is released the carbon, C, will be free to rise under the pressure of the mercury which is, however, controlled by a kind of porous piston, *c*, attached to the carbon holder, C^1, and fitting the glass lining of the tude, B. This piston may consist of wash-leather, as indicated in the drawing, or it may be a cup leather piston pierced with a fine hole to permit of the slow passage of the mercury through it. The plate, A^1, of the frame is pierced centrally to allow the carbon, C, to pass upwards through it, and it serves also to cover the electro-magnet, E, and the parts in connection therewith. The carbon, D, is fitted in the socket at the end of a rod pendent from the cross-bar of an electro-magnet, G. This magnet is supported by brackets, *g*, affixed to the plate, A^1, and underlying its poles is an armature, G^1, made fast to the pendent rod, D^1. When the lamp is not in action, the carbons, C and D, will be in contact with each other, the latter being pressed down by means of a coiled spring, D^2, but so soon as a current is passed through the lamp, the electro-magnet, G, will attract its armature, and thereby lift the carbon, D, from the carbon, C, to establish the arc. On the arrest of this current the carbon, D, will fall and be held firmly against the carbon, C, by means

of the coiled spring, D³. The terminal wires of the magnet, G, are connected the one through the plate, A², with the carbon, D, and the other through one of the pillars of the lamp frame with one pole of the electric generator by a wire, 1. In order to cause the electro-magnet, E, to regulate the carbon, C, with great accuracy, the following contrivance is adopted:—H is an electro-magnet placed within the circuit, one of its wires leading to the electric generator, and the other to the plate, A, in metallic connection with the lower carbon holder. Opposed to this electro-magnet, H, is an electro-magnet, H¹, between which oscillates an armature, I. The electro-magnet, H¹, connects with the electro-magnet, E, before mentioned, and is intended to impart rapidly intermittent currents thereto, for the purpose of enabling it to actuate the oscillating gripper, F, and allow the carbon, C, to rise gradually at an almost imperceptible rate. To this end one terminal of the electro-magnet, E, is connected to the plate, A, of the lamp, and through it with the wire, 2, from the electric generator and the other terminal of this magnet connects with one terminal of the magnet, H¹. By means of a coil of wire, *i*, the oscillating armature, I, is brought into connection with the second terminal of the electro-magnet, H¹. An extension of this armature, I, bears against a fixed stop, I¹, connected by a wire, *i*¹, to the wire, 1, leading to the electric generator. This takes place when the armature is attracted by the electro-magnet, H, as shown in the drawing, but as the resistance in the main circuit increases by the lengthening of the arc, a larger proportion of the current will pass by the branch circuit through the magnet, H¹, thereby increasing the attractive power of that magnet, and at the same time diminishing the attractive force of the magnet, H. So soon as the magnet, H¹, overpowers the magnet, H, the armature, I, will be drawn to the dotted position, and the magnets, E and H¹, will be thrown out of circuit. This will release the carbon, C, from the gripper, F, and leave it free to rise by its own buoyancy; it will however be instantly checked by reason of the magnet, H, again attracting the armature, I, and closing the branch circuit. The electro-magnet, E, being now again efficient will attract its armature and cause the carbon, C, to be gripped as before. By a succession of these movements the carbon, C, will be maintained at a proper distance from the carbon, D. To insure a greater delicacy of adjustment of the carbon, C, it is proposed to couple up the oscillating armature, I, and the fixed stop, I¹, inserting between them a rotary contact breaker, as at K, of any approved construction. This contact breaker may be driven by clockwork, or by a band from a motive power engine. The effect of this contact breaker will be to subdivide the intervals of rest of the electro-magnet, E, and thereby to produce a minute division of the step by step movement of the lower carbon.

2416. "Magneto-electric machine." FREDERIK WOLFF. (A communication from Professor Christopher Peter Jürgensen and Dr. Phil Professor Ludvig Valentin Lorenz, both of Copenhagen.) Dated June 1. 6d. This magneto-electric machine possesses, generally speaking, more electromotive power than any of the heretofore known machines acting on similar principles, and the total resistance of conduction in the machine is at the same time very insignificant. The weight and dimensions of the machine are also small, having regard to the power of production. Fig. 1 is an end view; fig. 2 a vertical longitudinal section; and fig. 3 a detail view of a magneto-electric machine constructed according to this invention. The machine is on the whole similar to the Gramme machine. It has hence an outer electro-magnet, a^1, a^2, a^3, an annular armature, b^1, having wire coil sections, b^2, and rotating between the poles of the electro-magnet, a contact cylinder, *c*, at one end, and brushes for

FIG.1.

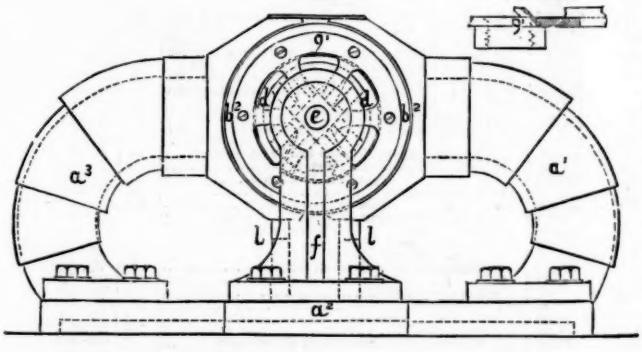
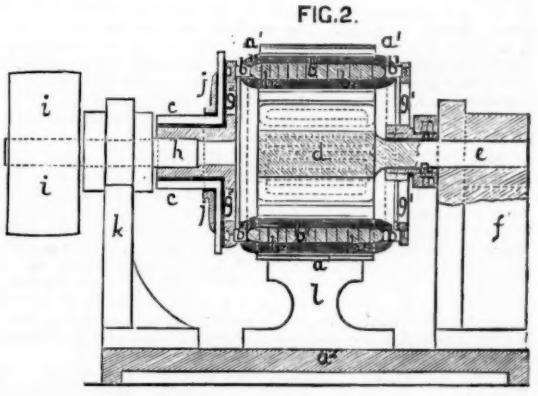


FIG.3.

collecting the electric current developed. The powerful action of the machine is mainly attained by the application of a central electro-magnet, *d*, inside the annular armature, b^1, b^2; this electro-magnet is, so to say, formed as two bar magnets placed crosswise, and having the north poles as well as the south poles respectively united by pole piece; this interior electro-magnet has a central gudgeon, *e*, which fits in a standard or bracket, *f*, and is held therein by screws, which, however, are not shown on the drawing, so that the north pole and south pole of the inner electro-magnet are opposite the north pole and south pole of the outer electro-magnet respectively. In order to further steady or secure the armature in its bearing in spite of the interior electro-magnet, there are unmagnetic rings, g^1, g^2, secured by studs projecting from the armature, b^1; of these rings one, g^1, has a central annular steel boss or ring which fits freely round the gudgeon, *e*, and has a projection, *n*, which works in the bearing, m^1, and the other ring, g^2, is fast on the spindle, *h*, whereby the armature is revolved and which consequently has a driving strap pulley, *i*. The armature, b^1, is divided into a number of rings arranged side by side, separated from each other by insulating pieces, the whole being held together by bolts placed midways between the aforesaid studs, b^3. By this arrangement induction currents in the armature, *b*, are prevented in the length direction parallel to the axis; whereby is also attained that very long armatures (that is, in the axial direction) may be used in combination with one or more outer electro-magnets, whereby the power of the machine may be greatly increased. In order to prevent damage to the insulating pieces on the wire coils, b^2, and in the armature, b^1, itself by too great heat produced therein during the working of the machine through the unpreventable resistance to conduction, the spokes which unite the ring, g^1, at the gudgeon end with its boss or nave are chamfered off on the edges, and may also have little wings, g^3, as shown in fig. 3, so that by the revolution of the armature a cooling air current into the armature may be produced in its length direction. The outer electro-magnet of the machine really consists of two electro-magnets, a^1 and a^3, which by the iron bed plate of the machine are united to a single horse-shoe shaped electro-magnet. To prevent hurtful vibration of these two pole parts, a^1 and a^3, they are steadied against each other at the top by an unmagnetic intermediate piece or plate, *p*, screwed thereto, and below by unmagnetic columns, *l*. In order to obtain the most powerful magnetism with the least conduction resistance, the wire coils are accumulated to the greatest extent near the pole pieces of the electro-magnet. The electric current to the inner and to the outer electro-magnet may either be taken from the main current of the machine itself or from a less number of separate wire sections on the armature of the machine, or, lastly, from another smaller electro-magnetic machine. The contact cylinder, *c*, or commutator, consists of angle shaped copper bars, which by a disc or ring, *j*, are fastened to the ring, g^2, which is fast on the spindle, *h*, but of course with insulating pieces between the said bars and the ring, g^2, and its centre boss, and the disc, *j*. The collecting brushes are not shown on the drawings, as they are of the usual form. They are arranged on the spindle-bearing bracket, *k*, so that they by being turned round the centre line of the spindle, *h*, may be set according to the neutral axis of the machine.

FIG.2.



2437. "Metallic circuits for electrical transmission." EDGAR EDMONDS. (A communication from abroad by George M. Mowbray, of America.) Dated June 2. 6d. Consists of two conductors combined and arranged in close proximity to each other, one uninsulated, say, of iron, with or without ground connections, the other insulated, the pair forming a complete metallic circuit for electrical purposes.

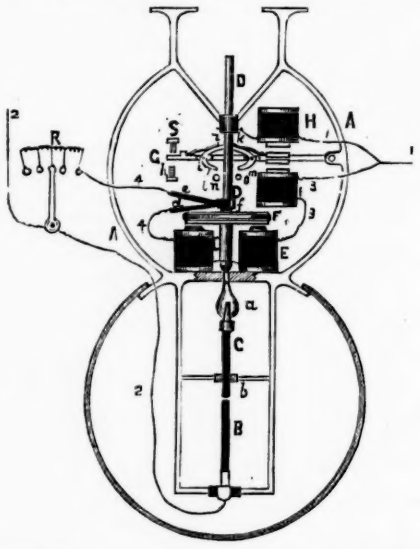
2449. "Apparatus for measuring mechanical and electrical power." C. V. BOYS. Dated June 3. Relates to apparatus whereby the quantity of mechanical or electrical force developed or employed can be measured and recorded.

2484. "Neutralisation of currents in telegraph and telephone lines." W. P. THOMPSON. (A communication from abroad by François Van Rysselberghe, of Brussels.) Dated June 8. 2d. In this invention the induced currents in the lines are practically neutralised by giving a resistance to the reception coil enormously greater than the line resistance, instead of the two being equalised, as is now the practice. This is done by multiplying the coils, or greatly increasing the length of the wires on the coils, or substituting wire of greater resisting qualities, such as iron or steel, for the copper wire usually employed. This greatly increased resistance kills the induced currents, or rather prevents their occurrence, only the line current having strength to conquer the resistance of the coil. (*Provisional only.*)

2492. "Electric lamps." PETER JENSEN. (A communication from abroad by Thomas Alva Edison.) Dated June 8. 8d. Relates chiefly to improved methods of manufacturing incandescent electric lamps.

2495. "Electric arc lights." E. G. BREWER. (A communication from abroad by Thomas Alva Edison.) Dated June 8. 6d. Relates to electric-arc lights using carbon pencils or rods, one or both of the carbons being fed forward lengthwise, and the object in view is such an improvement that the arc will remain perfectly steady at all times (except perhaps for an instant occasionally when the feeding of the carbon or carbons takes place) and the carbons will be consumed evenly. This is accomplished by rotating either or both of the carbon

pencils or rods around the longitudinal axis or axes of the same, the rotating mechanism not interfering with the feeding of the carbon or carbons. For feeding one or both carbons any mechanism can be used so far as the main features of the invention are concerned. It is preferred, however, to regulate the feed of the upper or positive carbon by means of an armature through an opening in which the metal-holding rod passes. This armature carries two pawls that clamp the rod to hold it up, the armature being supported by an electro-magnet in the lamp circuit. When however the resistance of the lamp circuit is increased to a certain point by the lengthening of the arc, or when the arc is ruptured, a magnet in a shunt or multiple-arc circuit overcomes the first magnet and draws the armature downwardly. The clamping pawls have arms which strike stops when the armature reaches its lowest position and throw the pawls away from the holding rod, allowing the carbon to drop. The magnet in the lamp circuit again becomes the more powerful and stops the further descent of the carbon, or raises the armature and carbon to re-establish the arc when ruptured. In the figure, A is the frame; B the lower or



negative carbon; and C the upper or positive carbon connected with the metal-holding rod, D, by ball and socket joint, *a*, and guided near its point by guide, *b*; 1, 2, are the main conductors; E, is the electro-magnet of the motor, the coils of which are in derived circuit, 3, 4, and are located on the frame, A, on opposite sides of the holding rod, D. The revolving armature, F, of the motor is supported by sleeve, *c*, from top of frame, A, through which sleeve slides the rod, D, the rod and sleeve being connected so as to rotate together by a feather or other suitable device. The commutator springs of the motor are represented by, *d*, *e*, while, *f*, is the revolving circuit breaker. An adjustable resistance, R, is placed in the motor circuit, 3, 4, by means of which the speed of the motor can be regulated. G, is the horizontal armature lever pivoted on the frame above the motor, and playing in the fields of two electro-magnets, H, I, the movement of the armature being limited by stops. The magnet, H, is in the lamp circuit, 1, 2, while I is in motor circuit, 3, 4. The rod, D, passes through an opening in lever, G, such lever being provided with spring pawls, *i*, *k*, that clamp downwardly on such rod. The pawls have arms, *l*, *m*, and stops, *n*, *o*, are located at such points on the frame that the pawls are thrown upwardly away from rod, D, when the armature lever reaches a certain point in its downward movement.

2532. "Electric cables." G. E. GOURAUD. (A communication from abroad by P. B. Delany and E. H. Johnson, both of New York.) Dated June 10. 6d. In this invention the separately insulated wires are arranged side by side, and have compressed upon them a metal covering (preferably of lead), the whole forming a flat cable, in which the inductive energy of the electric currents in any one of the conducting wires will be expended almost entirely upon the surrounding mass of conducting material instead of upon the adjacent wires, since the covering of the flat cable, although it may be of lower specific conductivity, has a much greater conducting area and is nearer to each one of the wires than the nearest of its neighbouring wires.

2538. "Electric and magnetic brakes, &c." M. R. WARD. Dated June 10. 6d. Relates to the utilisation of magnetism and electricity for arresting the motion of railway trains or other vehicles or vehicle in motion, and in applying for useful purposes the electric energy produced by such method of retardation. By this method of utilising electric and magnetic power the brake blocks now in use may be done away with, and the consequent wear and tear become non-existent, the motion may be alone retarded by the power required to produce the electric currents by dynamo-electric machines.

2542. "Electrical insulated wires and conductors." S. J. MACKIE. Dated June 11. 4d. This invention applies more particularly to single wires, double wires, and cores of small dimensions, although it is applicable also to cores of larger or of any dimensions. It consists in insulating the wire or wires by serving it or them with flat servings of jute, hemp, or other yarns, and saturating and combining the fibres of the same with the insulating material or compound so that the insulating coatings become so intimately combined together as to form a practically homogeneous substance. Wires so protected may be taped with one or more internal or structural tapings, and with a final external taping, and all these or any of them may be combined with the insulating material or compound; or the exterior taping or surface of the external juting may be waterproofed or insulated by some other special material.

2554. "Apparatus for receiving and transmitting audible signals by electricity." A. F. ST. GEORGE. Dated June 13. 2d. Has for its objects improved methods of constructing and arranging the parts of apparatus used for receiving and transmitting audible signals by means of electricity, so that such apparatus is more effective and economical in its operation than apparatus for the like purposes as ordinarily heretofore constructed and used. (*Provisional only.*)

2563. "Electric lamps." G. G. ANDRE. Dated June 13. 6d. The upper carbon is suspended from an iron rod, which is held up by magneto-frictional contact with or adhesion to pole pieces from one or more electro-magnets, such pole pieces being shaped to correspond with the round or other form of the iron rod. This latter is allowed to slide past the pole pieces, when the friction or adhesion due to magnetic attraction becomes lessened by the lengthening of the arc.

2572. "Electric lamps, &c." H. E. NEWTON. (A communication from abroad by C. A. Hussey and A. S. Dodd, of New York.) Dated June 14. Consists principally in the combination in an electric lamp with a translucent body capable of being rotated or turned, and containing within it two or more independent carbons, of means whereby when the body is rotated or turned the ends of the carbons or holders receiving the ends of the carbons are successively connected with the electric circuit in which the lamp is used, so that one carbon may replace another which is of no further use.

4168. "Governing apparatus for electric machines." W. P. THOMPSON. (A communication from abroad from Professor John Williams Langley, of America.) Dated September 27. 6d. Consists in suspending a piece of magnetic metal by suitable mechanism in such relation to the poles of the electro-magnet in a dynamo-electric machine that when such machine produces more current than is required by the work to be done by it, the attraction of the poles upon the piece of magnetic metal will become so strong as to overcome the resistance of the suspended mechanism, cause the piece of magnetic metal to approach the poles, and tend to establish magnetic communication between the poles, thereby reducing the current generated by the machine.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. Jan. 25.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	9¼ - ⅝	9⅜
		Do. Do.	10	22 - 23	
150,000	1	Electric Light and Power Generator Co.	1	1 - 1¼	1
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	48⅞ - 49¼	48⅞
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until }	100	76 - 77	76⅝ 7.6½
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c. has been paid to Pref. }	100	20½ - 21	
130,000	10	Brazilian Submarine, Limited	10	11¼ - 11⅝	11¼
16,000	10	Cuba, Limited	10	9 - 9½	
6,000	10	Do. 10 per cent. Preference	10	16½ - 17½	
13,000	10	Direct Spanish, Limited	9	5 - 5½	
6,000	10	Do. 10 per cent. Preference	10	14½ - 15½	
65,000	20	Direct United States Cable, Limited, 1877	20	10¼ - 10½	10⅜
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	100 -103	
380,000	10	Easte n, Limited	10	9¼ - 10¼	
70,000	10	Do. 6 per cent. Preference	10	12½ - 12¾	12½
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	105 -108	
199,750	10	Eastern Extension, Australasia & China, Limited	10	10⅛ - 10½	10⅜
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	103	109 -112	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	102 -105	
140,000	100	Do. do. registered, repayable 1900	100	102 -105	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	Eastern and South African Limited 5 per cent. } Mort. Deb. Registered redeemable 1 Jan. 1900 }	100	100 -103	
345,700*l.*	100	Do. do. do. To Bearer	100	100 -103	162½
22,050	10	German Union Telegraph and Trust, Limited	10	9½ - 10	
163,390	10	Globe Telegraph and Trust, Limited	10	6 - 6½	
163,209	10	Do. 6 per cent. Preference	10	12½ - 12⅝	
125,000	10	Great Northern	10	10¾ - 11¼	
100,000*l.*	100	Do. 5 per cent. Debentures	100	101 -104	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	25 - 26	
100,000	100	Do. 6 per cent. Debentures, 1886	100	104 -108	
17,000	25	Indo-European, Limited	25	28 - 29	
38,148	10	London Platino-Brazilian, Limited	10	4⅜ - 5¼	
12,060	10	Mediterranean Extension, Limited	10	2⅛ - 2⅜	
8,200	10	Do. 8 per cent. Preference	10	9¼ - 9⅝	
9,000	8	Reuter's, Limited	8	12½ - 12⅝	
280,000	Stk.	Submarine	100	280 -290	
58,225	1	Do. Scrip	1	2⅜ - 2⅝	
4,200	Cert.	Submarine Cables Trust	100	97 -100	
37,350	12	Telegraph Construction and Maintenance	12	28½ - 29½	
150,000	100	Do. 6 per cent. Bonds, 1884	100	101 -105	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1¼ - 1⅜	
30,000	10	West Coast of America, Limited	10	4½ - 5	
150,000	100	Do. 8 per cent. Debentures	..	.. ..	
69,910	20	Western and Brazilian, Limited	20	8 - 8¼	
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	110 -115	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	99 -103	100 ac.
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building)Bds.	$1,000	123 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	104 -107	
88,321	10	West India and Panama, Limited	10	1⅞ - 2	
34,563	10	Do. 6 per cent. 1st Preference	10	7⅛ - 8⅛	
4,669	10	Do. 6 do. 2nd do.	10	6 - 6¾	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1¼ - 1½	1⅝ m. 1⅛ ac.
200,000	1	Oriental Telephone Co.	½	⅜ - ½	
100,000	5	United Telephone Co.		11¾-12¼	11¾ .4